

## PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2000-207370

(43)Date of publication of application : 28.07.2000

(51)Int.Cl.

G06F 15/177

G06F 12/00

G06F 15/16

(21)Application number : 11-011513

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(22)Date of filing : 20.01.1999

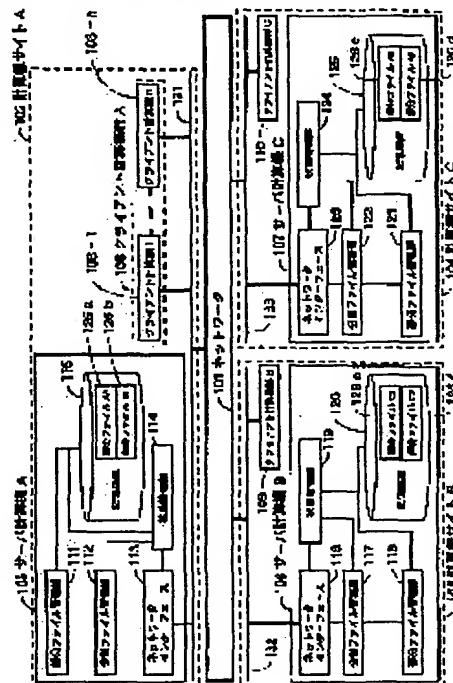
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## (54) DISTRIBUTED FILE MANAGEMENT DEVICE AND DISTRIBUTED FILE MANAGEMENT SYSTEM

## (57)Abstract:

PROBLEM TO BE SOLVED: To provide a distributed file management system which can make appropriate load distribution by means of plural server computers for generating, referring to and updating files.

SOLUTION: A distributed file management system is provided with server computers A, B, and C, client computer groups 108-110, and a network 101. The server computer A 105 is constituted of a storage device 115 which records partial files, a network interface 113, a partial file management section 111 which controls the write and read of the partial files, a status management section 114 which holds load information, and a distributed file management section 112. Since the arrangement of the partial files is determined, based on the load information of each server computer A, B, and C, the concentration of loads to a specific server computer can be avoided.



## LEGAL STATUS

[Date of request for examination]

29.01.2002

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the  
examiner's decision of rejection or application converted  
registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of  
rejection][Date of requesting appeal against examiner's decision of  
rejection]

[Date of extinction of right]

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## CLAIMS

[Claim(s)]

[Claim 1] Distributed file management equipment connected to the network where two or more server computers, 1, or two or more client computers which have a storage means characterized by providing the following to memorize data are connected. The state management tool which holds and manages the load information on two or more aforementioned server computers. A distributed file management means to determine the server computer which processes the aforementioned partial file based on the aforementioned load information which specifies the partial file of the aforementioned distributed file and is managed with the aforementioned state management tool corresponding to the processing demand of the distributed file from the aforementioned client computer.

[Claim 2] The aforementioned state management tool is distributed file management equipment according to claim 1 characterized by what it has for the external state management tool which holds the load information on the server computer which notified the aforementioned load information to other distributed file management equipments, and was notified from other distributed file management equipments as external load information.

[Claim 3] The aforementioned external state management tool is distributed file management equipment according to claim 2 characterized by what multicasting notifies the aforementioned load information for to distributed file management equipment besides the above.

[Claim 4] The aforementioned external state management tool is distributed file management equipment according to claim 2 or 3 characterized by what the aforementioned load information is notified for to other distributed file management equipments which adjoin among distributed file management equipment besides the above.

[Claim 5] Distributed file management system equipped with the network which connects two or more server computers characterized by providing the following, 1 or two or more client computers, two or more aforementioned server computers and the above 1, or two or more client computers. Each of two or more aforementioned server computers is a storage means to memorize the partial file which constitutes a part or all of a distributed file. A distributed file management means to determine the state management tool which holds and manages load information, and the server computer which processes the aforementioned partial file based on the aforementioned load information which specifies the partial file of the aforementioned distributed file and is managed with the aforementioned state management tool corresponding to the processing demand of the distributed file from the aforementioned client computer.

[Claim 6] The aforementioned state management tool notified the aforementioned load information to other server computers, and was notified from other server computers -- being concerned -- others -- the distributed file management system according to claim 5 characterized by what it has for the external state management tool which holds the load information on a server computer as external load information

[Claim 7] The aforementioned external state management tool is distributed file management system according to claim 6 characterized by what multicasting notifies the aforementioned load information for to a server computer besides the above.

[Claim 8] It is the distributed file management system according to claim 6 or 7 characterized by

what the aforementioned external state management tool notifies the aforementioned load information for to other server computers which belong to a predetermined server computer group among the above 1 or two or more server computer groups by carrying out the group division of two or more aforementioned server computers at 1 or two or more server computer groups.

[Claim 9] It is the distributed file management system according to claim 6 or 7 characterized by what the aforementioned external state management tool notifies the aforementioned load information for to other server computers belonging to the server computer group which adjoins among the above 1 or two or more server computer groups by carrying out the group division of two or more aforementioned server computers at 1 or two or more server computer groups.

[Claim 10] The aforementioned distributed file-management means is distributed file management system the distributed file-management equipment according to claim 2 to 4 characterized by what other server computers of a partial file and a movement place which move based on the access information for every aforementioned partial file, the aforementioned load information, and the aforementioned external load information are determined, and it has a distributed file move means move this partial file to this server computer for, 6, or given in nine.

[Claim 11] The aforementioned distributed file move means is the distributed file-management equipment according to claim 10 or the distributed file management system carry out what the load of the aforementioned storage means included in the aforementioned load information detects that it is size rather than a predetermined value, other server computers of a partial file and a movement place which move based on the aforementioned external load information and the aforementioned access information determine, and this partial file moves for to these server computers of other as the feature.

[Claim 12] The aforementioned distributed file move means is the distributed file-management equipment according to claim 10 or the distributed file management system carry out what the remaining capacity of the aforementioned storage means included in the aforementioned load information detects that it is smallness from a predetermined value, and determines other server computers of a partial file and a movement place which move based on the aforementioned external load information and the aforementioned access information, and this partial file moves for to these server computers of other as the feature.

[Claim 13] The aforementioned distributed file move means is the distributed file-management equipment according to claim 10 or the distributed file management system which carries out as the feature in what the load of the aforementioned network included in the aforementioned load information detects that it is size rather than a predetermined value, other server computers of a partial file and a movement place which move based on the aforementioned external load information and the aforementioned access information determine, and this partial file moves to these server computers of other for.

[Claim 14] The aforementioned distributed file move means The aforementioned load information, the aforementioned external load information, the aforementioned access information, And it is based on the initial entry between the aforementioned client computer and two or more aforementioned server computers. It asks for the communication cost between the server computer which has a storage means to hold the aforementioned partial file, and the client computer which performed the processing demand. Distributed file management equipment according to claim 10 or distributed file management system characterized by what other server computers which serve as communication cost of smallness from this communication cost are determined, and the aforementioned distributed file move means is the distributed file management equipment according to claim 10 to 14 or distributed file management system characterized by what it checks beforehand whether movement of the aforementioned partial file is possible for the server computer besides the above used as the movement place of the aforementioned partial file.

[Claim 16] The aforementioned distributed file move means is the distributed file management equipment according to claim 10 to 15 or distributed file management system characterized by what other partial files are moved for to the aforementioned server computer from a server

computer besides the above when the aforementioned partial file is moved to a server computer besides the above.

[Claim 17] The aforementioned distributed file move means is the distributed file management equipment according to claim 10 to 16 or distributed file management system which makes a list the candidate of other server computers which can move the aforementioned partial file, and is characterized by what other server computers which move the aforementioned partial file are determined for based on this list.

[Claim 18] The aforementioned distributed file move means is the distributed file management equipment according to claim 10 to 17 or distributed file management system characterized by what the information about the server computer which created the aforementioned partial file with movement of the aforementioned partial file is sent for to a server computer besides the above.

[Claim 19] The aforementioned distributed file-management means is distributed file-

management equipment or distributed file management system the claim 2 characterized by what other server computers of a partial file and a copy place to copy determine based on the access information for every aforementioned partial file, the aforementioned load information, and the aforementioned external load information, and it has a distributed file copy means copy the aforementioned partial file to a server computer besides the above for, 4 and 6, or given in 18.

[Claim 20] The aforementioned distributed file copy means is the distributed file-management equipment according to claim 19 or the distributed file management system characterized by what the load of the aforementioned storage means included in the aforementioned load information detects that it is size, determines other server computers of a partial file and a copy place which copy based on the aforementioned external load information and the aforementioned access information, and copies this partial file for to these server computers of other rather than a predetermined value.

[Claim 21] The aforementioned distributed file copy means is the distributed file-management equipment according to claim 19 or the distributed file management system characterized by what the load of the aforementioned network included in the aforementioned load information detects that it is size, determines other server computers of a partial file and a movement place copied based on the aforementioned external load information and the aforementioned access information, and copies this partial file for to these server computers of other rather than a predetermined value.

[Claim 22] The aforementioned distributed file copy means The aforementioned load information, the aforementioned external load information, It is based on the aforementioned access information and the initial entry between the aforementioned client computer and two or more aforementioned server computers. It asks for the communication cost between the server computer which has a storage means to hold the aforementioned partial file, and the client computer which performed the processing demand. Distributed file management equipment according to claim 19 or distributed file management system characterized by what other server computers which serve as communication cost of smallness from this communication cost are determined, and the aforementioned partial file is copied for to these server computers of other.

[Claim 23] The aforementioned distributed file copy means is the distributed file management equipment according to claim 19 to 22 or distributed file management system characterized by what it checks beforehand whether the copy of the aforementioned partial file is possible for to the server computer besides the above used as the copy place of the aforementioned partial file.

[Claim 24] The aforementioned distributed file copy means is the distributed file management equipment according to claim 19 to 23 or distributed file management system characterized by what other partial files are copied for to the aforementioned server computer from a server computer besides the above when the aforementioned partial file is copied to a server computer besides the above.

[Claim 25] The aforementioned distributed file copy means is the distributed file management equipment according to claim 19 to 24 or distributed file management system which makes a list the candidate of other server computers which can copy the aforementioned partial file, and is

characterized by what other server computers which copy the aforementioned partial file are determined for based on this list.

[Claim 26] The aforementioned distributed file copy means is the distributed file management equipment according to claim 19 to 25 and distributed file management system which are characterized by what other server computers of two or more copy places which copy the aforementioned partial file are chosen, and the aforementioned partial file is simultaneously copied for to two or more of other aforementioned selected server computers by multicasting.

[Claim 27] The aforementioned load information managed with the aforementioned state management tool is the distributed file management equipment according to claim 1 to 26 or distributed file management system characterized by what the capacity of the aforementioned storage means, a load, and the communication load between the aforementioned network and two or more aforementioned server computers are included for.

[Claim 28] Furthermore, the aforementioned server computer is the distributed file management equipment according to claim 1 to 27 or distributed file management system characterized by what it has for the partial file management means which writes the aforementioned partial file in the aforementioned storage means, and reads the aforementioned partial file from the aforementioned storage means.

[Claim 29] When the aforementioned processing demand from the aforementioned client computer is a creation demand of a distributed file, the aforementioned distributed file management means Divide this distributed file into two or more partial files, and the server

computer holding the partial file which divided is determined based on the aforementioned load information managed with the aforementioned state management tool. When the aforementioned processing demand from the aforementioned client computer is a reference demand or updating demand of a distributed file The existence of a partial file set as the object of processing of the aforementioned reference demand or the aforementioned updating demand is decided.

Distributed file management equipment according to claim 1 to 28 or distributed file management system characterized by what the server computer which processes the aforementioned processing demand is determined for based on the aforementioned load information managed with the aforementioned state management tool.

[Claim 30] The aforementioned distributed file management means is the distributed file management equipment according to claim 1 to 29 or distributed file management system characterized by what it has a partial file size determination means to determine the size of the aforementioned partial file which constitutes a part or all of a distributed file for based on the information from the aforementioned client computer.

[Claim 31] The aforementioned distributed file management means is the distributed file management equipment according to claim 1 to 29 or distributed file management system characterized by what it has a partial file size determination means to determine the size of the aforementioned partial file which constitutes a part or all of the aforementioned distributed file for based on the kind of data currently recorded on the distributed file.

[Translation done.]

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## DETAILED DESCRIPTION

[Detailed Description of the Invention]  
[0001]

[The technical field to which invention belongs] this invention relates to the distributed file management equipment and distributed file management system which distribute and manage a file to two or more terminals in a computer network system. In the server client type computer network system which connected two or more server computers and client computers especially in the network, it is related with the distributed file management equipment and distributed file management system which distribute and manage a file by two or more server computers.

[Description of the Prior Art] There is a distributed file system currently indicated by for example, JP.8-77054A public relations as distributed file management technology applied to the server client type computer network system (only henceforth a "network system") which connected two or more server computers and client computers in the network from the former. [0003] Drawing 30 shows the conventional distributed file system currently indicated by JP.8-77054A public relations. This conventional distributed file system is equipped with the network 3001 which connects two or more server computers 3002, 3003, 3004, and 3005, two or more client computers 3006, 3007, and 3008, and the server computers 3002, 3003, 3004, and 3005 and two or more client computers 3006, 3007, and 3008 of these plurality in drawing 30. [0004] Here, the partial file B-1 (3002-3) of the partial file A-1 (3002-1) of the distributed file A and the distributed file B is held at the server computer 3002. Moreover, the partial file B-2 (3003-2) of the partial file A-2 (3003-1) of the distributed file A and the distributed file B is held at the server computer 3003. Moreover, the partial file B-3 (3004-1) of the distributed file A and the distributed file B is held at the server computer 3004. [0005] Moreover, the server computer 3005 is equipped with each partial file A-1 to A-3 currently held at each server computers 3002, 3003, and 3004, and the distributed file management section 3005-2 which manages B-1 to B-3. Reference/updating demand distribution information 3005-1 for performing the distribution to a reference demand or updating demand (only henceforth "reference/updating demand") of the partial file from the client computers 3006, 3007, and 3008 is held.

[0006] The distributed file creation section 3006-1 in which the client computer 3006, on the other hand, creates the partial file of a distributed file according to a distributed file creation demand. The updating demand distribution section 3006-2 which determines the whereabouts of the partial file of this distributed file based on reference/updating demand distribution information 3005-1 on the server computer 3005 according to the updating demand to a distributed file. According to the reference demand to a distributed file, it has the reference demand distribution section 3006-3 which determines the whereabouts of the partial file of this distributed file based on reference/updating demand distribution information 3005-1 on the server computer 3005. In addition, other client computers 3007 and 3008 have same composition.

[0007] According to the conventional distributed file system mentioned above, when the user of the client computer 3006 demands creation of a distributed file, the distributed file creation

section 3006-1 of the client computer 3006 determines the server computer which creates the partial file of the distributed file concerned based on the distribution conditions decided beforehand, and creates the partial file of a distributed file to this server computer, for example. And reference/updating demand distribution information 3005-1 that it expresses with which server computer whether the partial file was created simultaneously with creation of this partial file is generated. It is transmitted to the server computer 3005 through a network 3001, and this reference/updating demand distribution information 3005-1 is held by the server computer 3005.

[0008] Moreover, when the user of the client computer 3006, for example, performs reference/updating demand which refers to or updates a distributed file, the client computer 3006 performs the open demand of the corresponding distributed file first to the distributed file management section 3005-2 of the server computer 3005. The distributed file management section 3005-2 of the server computer 3005 transmits reference/updating demand distribution information 3005-1 about the distributed file concerned to the client computer 3006 through a network 3001 corresponding to the open demand of the distributed file from the client computer 3006. The updating demand distribution section 3006-2 of the client computer 3006 or the reference demand distribution section 3006-3 transmits reference/updating demand to the server computer holding the partial file of a distributed file based on reference/updating demand distribution information 3005-1 received from the server computer 3005.

[0009] Thus, in the conventional distributed file system, when two or more processing demands concentrate to one distributed file by dividing a distributed file into two or more partial files, and distributing the processing (creation, reference, updating) to a distributed file to processing of a partial file unit, a load can be distributed, without centralizing a load on one server computer.

[0010] [Problem(s) to be Solved by the Invention] However, in the conventional distributed file system as shown in drawing 30, since the server computer which creates this partial file is determined based on the fixed distribution rule decided beforehand in case the partial file which constitutes a distributed file is created, it is not what took into consideration the load information on a realistic server computer in distribution of the file to a server computer. For this reason, the creation demand of a partial file may occur further to the server computer which access and processing concentrate and is high [a load] in fact. Therefore, the load of only a specific server computer may become large and there was a problem that a suitable load distribution was not performed by two or more server computers.

[0011] Moreover, it sets to the conventional distributed file system. Once it distributes a partial file to a server computer fixed based on the above-mentioned distribution rule After creation of a partial file after the distribution (i.e., the server computer which was able to be distributed) In order not to perform movement or the copy of a partial file which were created, when access to a specific partial file concentrated, there was a problem that the load by access could not be distributed.

[0012] Therefore, the purpose of this invention is offering the distributed file management equipment and distributed file management system which can perform a suitable load distribution by two or more server computers in creation of a file, reference, and updating.

[0013]

[Means for Solving the Problem] In order to solve the above-mentioned technical problem, the distributed file management equipment of the 1st mode concerning this invention it is distributed file management equipment connected to the network where two or more server computers, 1, two or more client computers which have a storage means to memorize data are connected. The state management tool which holds and manages the load information on two or more server computers, Corresponding to the processing demand of the distributed file from client computer, the partial file of a distributed file is specified and it is characterized by having a distributed file management means to determine the server computer which processes a partial file, based on the load information managed with the state management tool.

[0014] In the distributed file management equipment concerning an above-mentioned this invention A state management tool can also be equipped with the external state management

tool which holds the load information on the server computer which notified load information to other distributed file management equipments, and was notified from other distributed file management equipments as external load information.

[0015] You may make it an external state management tool notify load information to other management tool can also notify load information to other distributed file management equipments which adjoin among other distributed file management equipments.

[0016] In order to solve the above-mentioned technical problem, moreover, the distributed file management system of the 1st mode concerning this invention In the distributed file management system equipped with the network which connects two or more server computers, 1 or two or more client computers, two or more server computers and 1, or two or more client computers Each of two or more server computers A storage means to memorize the partial file which constitutes a part or all of a distributed file, State management tool which holds and manages load information It corresponds to the processing demand of the distributed file from a client computer. The partial file of a distributed file is specified and it is characterized by having a distributed file management means to determine the server computer which processes a partial file, based on the load information managed with the state management tool.

[0017] the distributed file management system concerning an above-mentioned this invention -- setting -- the state management tool notified load information to other server computers, and was notified from other server computers -- being concerned -- others -- you may make it have the external state management tool which holds the load information on a server computer as external load information Here, an external state management tool can also notify load information to other server computers by multicasting.

[0018] Moreover, it sets to the distributed file management equipment and distributed file management system concerning an above-mentioned this invention. Two or more server computers The group division is carried out at 1 or two or more server computer groups. An external state management tool You may make it notify load information to other server computers which belong to a predetermined server computer group among 1 or two or more server computer groups. Or you may make it an external state management tool notify the aforementioned load information to other server computers belonging to the server computer group which adjoins among 1 or two or more server computer groups.

[0019] Furthermore, a distributed file management means can determine other server computers of a partial file and a movement place which move based on the access information, load information, and external load information for every partial file, and can also be equipped with a distributed file move means to move this partial file to this server computer.

[0020] A distributed file move means detects that it is size here rather than a value predetermined in the load of the storage means included in load information. Other server computers of a partial file and a movement place which move based on external load information and access information are determined. this partial file -- these server computers of other -- moving -- you may make -- Or a distributed file move means detects that it is smallness from a value predetermined in the remaining capacity of the storage means included in load information. Other server computers of a partial file and a movement place which move based on external load information and access information are determined, and you may make it move this partial file to these server computers of other. Moreover, a distributed file move means detects that it is size rather than a value predetermined in the load of the network, included in load information, other server computers of a partial file and a movement place which move based on external load information and access information -- determining -- this partial file -- these server computers of other -- it can also move -- A distributed file move means Or load information, external load information, access information, And it is based on the initial entry between a client computer and two or more server computers. It asks for the communication cost between the server computer which has a storage means to hold the partial file, and the client computer which performed the processing demand, other server computers which serve as communication cost of smallness from this communication cost are determined, and you may make it move a partial file to these server computers of other.

[0021] Furthermore, a distributed file move means can also check beforehand whether movement of the aforementioned partial file is possible to other server computers used as the movement place of a partial file. When a distributed file move means moves a partial file to other server computers, it can also move other partial files to a server computer from other server computers again. Furthermore, a distributed file move means makes a list the candidate of other server computers which can move a partial file, and you may make it determine other server computers which move a partial file based on this list. Moreover, a distributed file move means can send the information about the server computer which created the partial file with movement of a partial file to other server computers.

[0022] Moreover, an above-mentioned distributed file management means can determine other server computers of a partial file and a copy place to copy based on the access information, load information, and external load information for every partial file, and can also be equipped with a distributed file copy means to copy a partial file to other server computers.

[0023] At this time, a distributed file copy means detects that it is size rather than a value predetermined in the load of the storage means included in load information. Other server computers of a partial file and a copy place copied based on external load information and access information are determined. You may make it copy this partial file to these server computers of other. A distributed file copy means The load of the network included in load information detects that it is size, and determines other server computers of a partial file and a movement place copied based on external load information and access information, and you may make it copy this partial file to these server computers of other rather than a predetermined value. Or a distributed file copy means asks for the communication cost between the server computer which has a storage means hold the partial file, and the client computer which performed the processing demand based on load information, external load information, access information, and the initial entry between a client computer and two or more server computers, determines other server computers which serve as communication cost of smallness from this communication cost, and can copy a partial file to these server computers of other.

[0024] Here, as for a distributed file copy means, it is good to check beforehand whether the copy of a partial file is possible to other server computers used as the copy place of a partial file. Moreover, when a distributed file copy means copies a partial file to other server computers, it may copy other partial files to a server computer from other server computers. Moreover, a distributed file copy means makes a list the candidate of other server computers which can copy a partial file, and can determine other server computers which copy a partial file based on this list. Furthermore, a distributed file copy means can choose other server computers of two or more copy places which copy a partial file, and can also copy a partial file to two or more of other selected server computers simultaneously by multicasting.

[0025] Moreover, the load information managed with the state management tool can contain the capacity of a storage means, a load, and the communication load between a network and two or more server computers.

[0026] Furthermore, it sets to the distributed file management equipment and distributed file management system concerning an above-mentioned this invention. A server computer can also be equipped with the partial file management means which writes a partial file in a storage means, and reads a partial file from a storage means.

[0027] Moreover, distributed file management means When the processing demand from a client computer is a creation demand of a distributed file Divide this distributed file into two or more partial files, and the server computer holding the partial file which divided is determined based on the load information managed with the state management tool. When the processing demand from client computer is a reference demand or updating demand of a distributed file the existence of a partial file set as the object of processing of a reference demand or an updating demand is decided, and the server computer which processes a processing demand is determined based on the load information managed with the state management tool -- you may make it like

[0028] Moreover, a distributed file-management means can have a partial file size determination means determine the size of the partial file which constitutes a part or all of a distributed file,



based on the information from a client computer. Or a partial file size determination means determine the size of the partial file which constitutes a part or all of a distributed file may make a distributed file-management means have based on the kind of data currently recorded on the distributed file.

[0029] In the distributed file management equipment and distributed file management system concerning an above-mentioned this invention, since the server computer by which a distributed file management means arranges a partial file based on the load information on a server computer is determined, concentration of the load to a specific server computer is avoidable.

[0030] Moreover, since the server computer by which a distributed file management means arranges a partial file based on the load information on other server computers is determined, it is avoidable that a load concentrates by the specific server computer.

[0031] Moreover, the imbalance of concentration of the load to the storage means of a specific server computer and the capacity of a storage means is avoidable by moving a partial file to other server computers. Moreover, concentration of the load to the storage of a specific server computer is avoidable by copying a partial file to other server computers.

[0032] Moreover, since the size of the partial file which constitutes a distributed file can be changed suitably, it is avoidable to divide into two or more partial files the data which have relation logically and in content, for example, the data for one picture etc.

[0033]

[Embodiments of the Invention] Hereafter, the gestalt of operation of the distributed file management equipment of this invention and distributed file management system is explained using drawing 29 from drawing 1.

[0034] (Gestalt 1 of operation) Drawing 1 is the block diagram showing an example of the gestalt of operation of the 1st of the distributed file management system in this invention. It set to drawing 1 and this distributed file management system is equipped with the networks 101, such as a Local Area Network which connects mutually two or more computers site A102 equipped with the client computer group which consists of two or more client computers, such as server computers, such as a personal computer and a workstation, and a personal computer, and a workstation, the computer site B103 and the computer site C104, the computer site A102 and the computer site B103, and the computer site C104, and a Wide Area Network.

[0035] Here, the computer site A102 is equipped with two or more server computers (only "the server computer A105" is shown in drawing 1), such as a personal computer and a workstation, and the client computer group A108 which consists of client computer 1-n (108-1 - 108-n), such as a personal computer and a workstation. This computer site A102 has connected two or more server computers (only "the server computer A105" is shown in drawing 1) and client computer groups A108 in the internal networks 131, such as Ethernet, for example, has become the Internet domain.

[0036] Moreover, like the computer site A102, the computer site B103 was equipped with the client computer group B109 which consists of two or more server computers (only "the server computer B106" is shown in drawing 1), and two or more client computers, and the computer site C104 is equipped with the client computer group C110 which consists of two or more server computers (only "the server computer C107" is shown in drawing 1), and two or more client computers. Furthermore, these computer sites B103 and the computer site C104 -- the computer site A102 -- the same -- two or more server computers (in drawing 1, only the "server computer B106" and the "server computer C107" are shown), and the client computer groups B109 and the client computer groups C110 -- each -- it has connected in the internal network 132 and the internal network 133, for example, has become the Internet domain [0037] The storage 115, such as a hard disk with which the server computer A105 records the partial file of a distributed file. The network interface 113 for connecting with the internal networks 131, such as Ethernet. The partial file management section 111 which controls the writing and read-out to the storage 115 which is recording the partial file. With the state Management Department 114 which supervises the load to storage 115, the remaining capacity of storage 115, and the load to a network interface 113, and holds the information about such loads and capacity it is constituted by the partial file management section 111, the state

Management Department 114, and the distributed file management section 112 connected to the network interface 113.

[0038] This distributed file management section 112 directs writing and read-out of a partial file in the partial file management section 111. Moreover, when creating a distributed file, based on the information acquired from the state Management Department 114, the distributed file management section 112 divides a distributed file into two or more partial files, and determines the server computer which arranges each partial file (record). Moreover, in referring to or updating the distributed file created before, it determines the server (recorded) computer by which the partial file of the corresponding distributed file exists.

[0039] The server computer B106 and the server computer C107 have the same composition as the server computer A105. That is, the server computer B106 is constituted by storage 120, a network interface 118, the partial file management section 116, the state Management Department 119, and the distributed file management section 117. Moreover, the server computer C107 is constituted by storage 125, a network interface 123, the partial file management section 121, the state Management Department 124, and the distributed file management section 122.

[0040] Drawing 2 is drawing showing an example of the composition of a distributed file. The distributed file 201 is constituted by two or more partial files 202-1 - 202-n in drawing 2.

[0041] In drawing 1, the state after each distributed files A, B, and C were created is shown. That is, the partial file A1 (126a) of the distributed file A and the partial file B1 (126b) of the distributed file B are recorded on the storage 115 of the server computer A105. Moreover, the partial file C1 (126c) of the distributed file C and the partial file C2 (126f) of the distributed file C are recorded on the storage 120 of the server computer B106. Moreover, the partial file A2 (126e) of the distributed file A and the partial file A3 (126d) of the distributed file A are recorded on the storage 125 of the server computer C107.

[0042] Next, operation of the distributed file management system constituted as mentioned above is explained. The creation demand of the distributed file A is published to the server computer A105 from the client computer 1 (108-1) of the client computer group A108 below, and distributed processing in case the partial files A1-A3 as shown in drawing 1 are created is made into an example, and is explained. Here, the storage 115, 120, and 125 shown in drawing 1 shall have two or more storage sections or storage regions (only henceforth the "storage section"), respectively. Two or more of these storage sections may be one record medium physically, and may be two or more record media.

[0043] In drawing 1, the creation demand of the distributed file A is first published by the server computer A105 from the client computer 1 (108-1). The creation demand of this distributed file A is received by the distributed file management section 112 of the server computer A105 through the network interface 113 of the internal network 131 and the server computer A105. [0044] Drawing 3 is a flow chart which shows the algorithm of the distributed file management section at the time of receiving the creation demand of a distributed file of operation. Hereafter, detailed operation of the distributed file management section 112 is explained using drawing 1 and drawing 3.

[0045] The distributed file management section 112 which received the creation demand of the distributed file A acquires first the load information which the state Management Department 114 has managed (Step 301).

[0046] Drawing 4 is drawing showing the load information table 401 managed at the state Management Department 114. In drawing 4, the load information table 401 consists of the storage load information network load information table 402 and 403.

[0047] This storage load information table 402 consists of items of the "remaining capacity" which indicates the remaining capacity [Mbytes] of each storage section to be the "load" which indicates the load information on each storage section [%] to be the "storage identifier" for discriminating two or more storage sections of the storage 115 connected to the server computer A105. Here, the "load" of each storage section of storage 115 shows what % of the maximum transfer rates of each storage section of storage 115 is used.

[0048] Moreover, the network load information table 403 The data sent out on a network 101

through a network interface 113 [ what bandwidth (use communication-band width of face [Mbps]) is used by being sent out towards which computer site (sending-out place site), and ] Moreover, the received data are sent from which computer site (sending-out agency site), and it is shown whether it has received using the bandwidth (use communication-band width of face [Mbps]) of how much. The item of this "sending-out agency site" shows the computer site of the sending-out origin of data, and the item of a "sending-out place site" shows the computer site of the sending-out place of data. That is, in SiteA, SiteB shows the computer site B108 and SiteC shows the computer site C107 for the computer site A105. Here, a transmitting agency site and a transmission place site are named generically, and it is called a *network link* (only henceforth a "link"). Moreover, the item of "use communication-band width of face" shows the communication-band width of face [Mbps] currently used between the sending out agency site and the sending-out place site.

[0049] That is, when the distributed file management section 112 receives the creation demand of the distributed file A, the distributed file management section 112 acquires the information that the load of the storage section of the storage identifier DiskID1 is 20 [%], and remaining capacity is 10 [Mbytes] based on the information on the storage load information table 402 gained from the state Management Department 114, as shown in drawing 4 (Step 301).

[0050] Next, based on the information on the storage load information table 402 obtained from the state Management Department 114, out of the storage 115 connected to the server computer A105, remaining capacity fully remains, and a load chooses the low storage section from a predetermined threshold, and the distributed file management section 112 assigns the partial file in order to this storage section. Here, as a threshold, it is good to use 80 [%] etc. for example. However, this threshold can be suitably determined according to the composition of storage 115 etc. Moreover, the size of a partial file has a desirable fixed length, and it is good to make it the same size by all server computers. At this time, when all the partial files A1-A3 are assigned by the storage section of storage 115, Step 304 is processed. On the other hand, Step 303 is processed when all the partial files A1-A3 are not assigned by the storage section of storage 115 (Step 302).

[0051] In the case of the gestalt ( drawing 1 ) of this operation, all the partial files A1-A3 are assigned to the storage section of storage 115 — having not had (Step 302) — the partial file A1 (126a) of the distributed file A is assigned to the server computer A105, and the remaining partial files A2 and A3 are assigned to other server computers C107

[0052] The distributed file management section 112 asks whether the partial files A2 and A3 can be created through the internal network 131 and a network 101 to other server computers, in order to assign the partial files A2 and A3 which were not assigned at Step 302 to other server computers. By other server computers which received the inquiry, the load information table 401 of the state Management Department of self is investigated, and it answers [ whether creation of the partial files A2 and A3 is possible, and ] (Step 303). The distributed file management section of each server computer will perform an exchange of an inquiry of creation of this partial file, and the signal of an answer through a network interface and a network.

[0053] In the case of the gestalt ( drawing 1 ) of this operation, the distributed file management section 112 asks the distributed file management section 122 of the server computer C107 of the computer site C104 whether creation of the partial file A2 (126c) and the partial file A3 (126d) can be performed through a network interface 113 and a network 101. Based on the load information table 401 obtained from the state Management Department 124, the distributed file management section 122 of the server computer C107 performs the same judgment as the above-mentioned step 302, and answers [ whether creation of the partial file A2 (126c) and the partial file A3 (126d) can be performed, and ] the server computer A105 (Step 303). In the case of drawing 1, to the storage 125 of the server computer C107, the partial file A2 (126c) and the partial file A3 (126d) can be created.

[0054] Next, the distributed file management section 112 of the server computer A registers the information for managing the partial file A1 assigned to the storage 115 of the server computer A, and the partial files A2 and A3 assigned to the storage 125 of other server computers C (Step 304).

[0055] Drawing 5 is drawing showing the distributed file control table 501. Moreover, drawing 8 is drawing showing the partial file control table 601. In drawing 5, the distributed file control table 501 consists of items of "the partial file identification child list of [ for discriminating the partial file which constitutes the "distributed file identification child" and distributed file for discriminating a distributed file ]." Moreover, in drawing 8, the partial file control table 601 consists of items of the "address" which shows the "partial file identification child" for discriminating a partial file, and the address of a partial file. Here, the "partial file identification child" who showed drawing 6 is equivalent to the "partial file identification child" who constitutes the "partial file identification child list" shown by drawing 5.

[0056] If it sees about the distributed file A, in drawing 5, it expresses that the distributed file A consists of a partial file A1 (126a), a partial file A2 (126c), and a partial file A3 (126d) with the case of the gestalt ( drawing 1 ) of this operation, for example. Moreover, in drawing 6, the address of the partial file A1 (126a) is "file://siteA/serverA/DiskID1/(storage identifier DiskID1 of the server computer A105 of the computer site A102)." The address of the partial file A2 (126c) is "file://siteC/serverC/DiskID2/(storage identifier DiskID2 of the server computer C107 of the computer site C104)." The address of the partial file A3 (126d) expresses that it is "file://siteC/serverC/DiskID2/(storage DiskID2 of the server C107 of the computer site C104)."

[0057] Next, when creating the partial file A1 to the storage 115 of the server computer A, through the partial file management section 111, the distributed file management section 112 writes the data from the client computer 1 (108-1) in storage 115, and creates the partial file A1 of the distributed file A. When recording the partial files A2 and A3 on other server computers C107, moreover, the distributed file management section 112 Request record of the partial files A2 and A3 from the distributed file management section 122 of the server computer C107 which records, and, simultaneously with it, it directs to the client computer 1 (108-1) which performed the creation demand of the distributed file A. Immediate data are transmitted to the server computer C107 which performs record from the client computer 1 (108-1). By the server computer C107 which received the request, the distributed file management section 122 registers the partial files A2 and A3 to the partial file control table 601, thus, other server computers C107 top — the partial file A — 2 and 3 are created (Step 305)

[0058] above — carrying out — creation of the partial file A1 (126a) of the distributed file A — the data from the client computer 1 (108-1) — the storage 115 of the server computer A105 — \*\*\*\*\* — it is carried out by things Moreover, creation of the partial file A2 (126c) of the distributed file A and the partial file A3 (126d) sends the data from the client computer 1 (108-1) to the \*\*\* server computer C107, and is performed by writing in the storage 125 of the server computer C107.

[0059] Moreover, in the above-mentioned step 303, by all other server computers, when creation of a partial file is impossible, the distributed file management section 112 notifies that creation of a distributed file went wrong to the client computer 1 (108-1) which performed the creation demand of a distributed file (Step 306).

[0060] On the other hand, at Step 302, when creation of all the partial files of a distributed file is made to the storage of the server computer of self, the distributed file management section 112 is registered into the partial file control table 601 having shown the information for managing the distributed file assigned to storage 115 in the distributed file control table 501 shown in drawing 5, and drawing 6 (Step 307).

[0061] Next, through the partial file management section 111, the distributed file management section 112 writes the data from the client computer 1 (108-1) in storage 115, and creates all partial files (Step 308).

[0062] As mentioned above, according to the distributed file management system of this invention, since creation of a distributed file is performed in consideration of the load of each server computer, a load distribution comes be made appropriately.

[0063] Next, the case where distributed file reference / updating demand is published to the server computer A105 from the client computer 1 (108-1) in the client computer group A108 is explained.

[0064] First, reference/updating demand to the distributed file A published from the client computer 1 (108-1) is received by the distributed file management section 112 through a network interface 113 in the server computer A105.

[0065] Drawing 7 is a flow chart which shows the algorithm of the distributed file management section at the time of receiving reference/updating demand of a distributed file of operation. Hereafter, detailed operation of the distributed file management section 112 is explained using drawing 7. Moreover, in the following, concrete operation which made the example processing of reference/updating demand to the distributed file A is also explained.

[0066] First, the distributed file management section 112 is based on reference/updating demand of the distributed file from the client computer 1 (108-1), from the distributed file control table 501 and the partial file control table 601, specifies the partial file referred to / updated, and asks for the address of the partial file (Step 701).

[0067] Here, as for the distributed file management section 112, in reference/updating demand to the distributed file A from the client computer 1 (108-1), based on the distributed file control table 501, it turns out that the distributed file A is constituted by the partial file A1 (126a), the partial file A2 (126c), and the partial file A3 (126d). It is based on the partial file control table 601, moreover, the address of the partial file A1 (126a) is "file:///siteA/ServerA/DiskID1/601, moreover, the address of the partial file A2 (126c) is "file:///siteA/ServerA/DiskID1/(storage identifier DiskID1 of the server computer A105 of the computer site A102)." The address of the partial file A3 (126d) is "file:///siteC/ServerC/DiskID2/(storage identifier DiskID2 of the server computer C107 of the computer site C104)." It turns out that the address of the partial file A3 (126d) is "file:///siteC/ServerC/DiskID2/(storage identifier DiskID2 of the server C107 of the computer site C104)."

[0068] The distributed file management section 112 judges whether all the partial files that perform reference/updating exist in the storage 115 of the server computer A105 of self, a part, or all partial files exist in other server computers from the address of the partial file obtained at Step 701 (Step 702).

[0069] Here, in the case of the distributed file A, it exists in storage 115 and, as for the partial file A1 (126a), it turns out that partial FAIRU A2 (126c) and the partial file A3 (126d) exist in the storage 125 of the server computer C107 of the computer site C104.

[0070] Next, when all partial files do not exist in the storage 115 of the server computer A105 of self (Step 702), based on the address of the partial file obtained at Step 701, existence of a partial file is confirmed to other server computers by which the partial file which performs reference/updating is recorded (Step 703).

[0071] Here, in the case of the distributed file A, existence of the partial file A2 (126c) and the partial file A3 (126d) is checked at the distributed file management section 122 of the server computer C107 of the computer site C104.

[0072] If existence of a partial file is checked at Step 703, the distributed file management section 112 will perform read-out (reference) of the partial file which exists in storage 115 through the partial file management section 111, and the writing (updating) to a partial file which performs reference/updating demand from the client computer 1 (108-1), when the partial file which performs reference/updating exists in the storage 115 of the server computer A105 of self. Moreover, when the partial file which performs reference/updating exists in the storage of other server computers, the distributed file management section 112 requires the reference/renewal of an applicable partial file of the server computer holding the partial file which performs reference/updating. It can come, simultaneously the distributed file management section 112 directs to give reference/updating demand to the server computer holding the partial file to which the \*\*\*\*\* client computer 1 (108-1) gives reference/updating demand for reference/updating directly (Step 704).

[0073] Here, in the case of the distributed file A, the partial file A1 (126a) exists in the server computer A105 of the computer site A102, and the partial file A2 (126c) and the partial file A3 (126d) exist in the server computer C107 of the computer site C104. As for reference/updating demand to the partial file A1 (126a), the distributed file management section 112 performs reference/update process to storage 115 through the partial file management section 111. On the other hand, reference/updating demand to the partial file A2 (126c) and the partial file A3

(126d) will be directly performed between the client computers 1 (108-1) and the server computers C107 which performed reference/updating demand.

[0074] Moreover, when existence of a partial file is not checked at Step 703, the distributed file management section 112 notifies what the reference/renewal of a distributed file failed in the client computer 1 (108-1) which performed reference/change request of a distributed file (Step 705).

[0075] On the other hand, at Step 702, when all partial files exist in the storage 115 of the server computer A105 of self, the distributed file management section 112 performs read-out (reference) of the partial file which exists in storage 115 through the partial file management section 111, and the writing (updating) to a partial file based on reference/updating demand from the client computer 1 (108-1) (Step 706).

[0076] As mentioned above, according to the gestalt of operation mentioned above, when the demand to a server computer from a client computer is creation of a distributed file, a distributed file is divided into two or more partial files, the server computer which creates each partial file based on the load information on a server computer is determined for every partial file, and creation processing of a distributed file is carried out. Moreover, when the demands from a client computer are the reference/renewal of a distributed file, the server computer by which the partial file which constitutes a distributed file exists is specified, and the partial file distributed and arranged on 1 or two or more server computers is treated as one distributed file from a client computer. Thus, concentration of the load to a specific server computer can be lost in the case of creation / reference / change request of the distributed file from a client computer to a server computer.

[0077] (Gestalt 2 of operation) Drawing 8 is the block diagram showing an example of the gestalt of operation of the 2nd of the distributed file management system in this invention. In this drawing 8, the same sign is given to the same composition as drawing 1. The distributed file management system shown in drawing 8 is equipped with the networks 101, such as a Local Area Network which connects mutually two or more computers site A802 equipped with the client computer group which consists of two or more client computers, such as server computers, such as a personal computer and a workstation, and a personal computer, and a workstation, the computer site B803 and the computer site C804, the computer site A802 and the computer site B803, and the computer site C804, and a Wide Area Network.

[0078] Here, the computer site A802 is equipped with two or more server computers (only "the server computer A805" is shown in drawing 8), such as a personal computer and a workstation, and the client computer group A108 which consists of client computer 1-n (108-1 - 108-n), such as a personal computer and a workstation. This computer site A802 has connected two or more server computers (only "the server computer A805" is shown in drawing 8) and client computer groups A108 in the internal networks 131, such as Ethernet, for example, has become the Internet domain.

[0079] Moreover, like the computer site A802, the computer site B803 was equipped with the client computer group B109 which consists of two or more server computers (only "the server computer B806" is shown in drawing 8), and two or more client computers, and the computer site C804 is equipped with the client computer group C110 which consists of two or more server computers (only "the server computer C807" is shown in drawing 8), and two or more client computers, furthermore, these computer sites B803 and the computer site C804 -- the computer site A802 -- the same -- two or more server computers (in drawing 8, only the "server computer B806" and the "server computer C807" are shown), and the client computer groups B109 and the client computer groups C110 -- each -- it has connected in the internal network 132 and the internal network 133, for example, has become the Internet domain [0080] The storage 115, such as a hard disk with which the server computer A805 records the partial file of a distributed file. The network interface 113 for connecting with the internal networks 131, such as Ethernet. The partial file management section 111 which controls the writing and read-out to the storage 115 which is recording the partial file. With the state Management Department 814 which supervises the load to storage 115, the remaining capacity of storage 115, and the load to a network interface 113, and holds the information about such



loads and capacity it is constituted by the partial file management section 111, the state Management Department 814, and the distributed file management section 112 connected to the network interface 113.

[0081] This state Management Department 814 has the external state Management Department 811 holding the external load information which notified load information to other server computers, and was notified from other server computers.

[0082] The server computer B806 and the server computer C807 have the same composition as the server computer A805. That is, the server computer B806 is constituted by storage 120, a network interface 118, the partial file management section 116, the state Management Department 819 having the external state Management Department 812, and the distributed file management section 117. Moreover, the server computer C807 is constituted by storage 125, a network interface 123, the partial file management section 121, the state Management Department 824 having the external state Management Department 813, and the distributed file management section 122.

[0083] The difference with the distributed file management system shown in the distributed file management system shown in drawing 8 and drawing 1 here is a point equipped with the external state Management Department 811, 812, and 813 where the state Management Department 814, 819, and 824 which showed drawing 8 holds the external load information which notified load information to other server computers, and was notified from other server computers.

[0084] Drawing 9 shows an example of the external load information table 901 managed at the external state Management Department 811, 812, and 813. In drawing 9, the external load information table 901 consists of items of the "storage load information" which shows the load information on the storage of the server computer shown in the "server computer address" which shows the address of a server computer, and a server computer address. Moreover, "storage load information" consists of items of the "remaining capacity" which indicates the remaining capacity of storage to be the "load" which shows the "storage identifier" for discriminating storage, and the load of storage.

[0085] The external state Management Department 811, 812, and 813 performs the following table operation, in order to notify the external load information from the external load information table 901 to other server computers.

[0086] First, the external state Management Department 811, 812, and 813 acquires the information on the storage load information table 402 managed at the state Management Department 814, 819, and 824 by having the change of state of the information which asks the information shown in the storage load information table 402 to the state Management Department 814, 819, and 824 to periodical or predetermined timing, or is shown in the storage load information table 402 from the state Management Department 814, 819, and 824 notified.

[0087] Next, the external state Management Department 811, 812, and 813 notifies storage load information to each server computer through each network interface 113, 118, and 123. By the server computer which received the notice, through network interfaces 113, 118, and 123, the external state Management Department 811, 812, and 813 receives storage load information, and records this information on each external load information table 901, respectively.

[0088] The case where the creation demand of the distributed file A is published to the server computer A805 about the distributed file management system constituted as mentioned above from the client computer 1 (108-1) in the client computer group A108 is explained as an example.

[0089] First, the creation demand of the distributed file A published from the client computer 1 (108-1) is received by the distributed file management section 112 through the network interface 113 of the internal network 131 and the server computer A805.

[0090] Drawing 10 is a flow chart which shows the algorithm of the distributed file management section when receiving the creation demand of a distributed file of operation. Hereafter, detailed operation of the distributed file management section is explained using drawing 10. In the gestalt of this operation, processing of Step 302 and Step 303 which are shown in drawing 3 explained with the gestalt of the 1st operation can be unified, and it can process at one step 1002.

[0091] First, the distributed file management section 112 acquires each information from the

load information table 401 which the state Management Department 814 has managed, and the external load information table 901 which the external state Management Department 811 has managed (Step 1001).

[0092] At this state Management Department 114, the load information table 401 as shown in drawing 4 is managed. The load information table 401 is constituted by the storage load information table 402 and the network load information table 403 in drawing 4.

[0093] This storage load information table 402 consists of items of the "remaining capacity" which indicates the remaining capacity [Mbytes] of each storage section to be the "load" which indicates the load information on each storage section [%] to be the "storage identifier" for discriminating two or more storage sections of the storage 115 connected to the server computer A105. Here, the "load" of each storage section of storage 115 shows what % of the maximum transfer rates of each storage section of storage 115 is used.

[0094] Moreover, the network load information table 403 The data sent out on a network 101 through a network interface 113 [ what bandwidth (use communication-band width of face [Mbps]) is used by being sent out towards which computer site (sending-out place site), and ] Moreover, the received data are sent from which computer site (sending out agency site), and it is shown whether it has received using the bandwidth (use communication-band width of face [Mbps]) of how much. The item of this "sending out agency site" shows the computer site of the sending-out origin of data, and the item of a "sending-out place site" shows the computer site of the sending-out place of data. That is, in SiteA, SiteB shows the computer site B106 and SiteC shows the computer site C107 for the computer site A105. Here, a transmitting agency site and a transmission place site are named generically, and it is called a network link (only henceforth a "link"). Moreover, the item of "use communication-band width of face" shows the communication-band width of face [Mbps] currently used between the sending out agency site and the sending-out place site.

[0095] Moreover, the external state Management Department 811 has managed the external load information table 901 as shown in drawing 9.

[0096] Here, when creating the distributed file A, the "load" of the storage section of the storage 115 in which a "storage identifier" is shown by DiskID1 is 20 [%], and the distributed file management section 112 can acquire the information that "remaining capacity" is 10 [Mbytes] from the load information table 401 of the state Management Department 814. The distributed file management section 112 moreover, from the external load information table 901 of the external state Management Department 814 The "load" of the storage section of the storage 120 in which the "storage identifier" of the server computer B806 of the computer site B803 is shown by DiskID1 by 49 [%] The "load" of the storage section of the storage 125 in which "remaining capacity" is 1000 [Mbytes] and the "storage identifier" of the server computer C807 of the computer site C804 is shown by DiskID1 by 30 [%] The information that "remaining capacity" is 3000 [Mbytes] can be acquired.

[0097] Next, the distributed file management section 112 is first based on the storage load information table 402 obtained from the state Management Department 814. "Remaining capacity" out of each storage section of the storage 115 connected to the server computer A805 above a predetermined capacity And a "load" chooses the storage section which fulfills the conditions of being lower than a predetermined threshold, and assigns the partial file which divided the distributed file in order to each storage section which fulfills the conditions concerned. When all partial files are not assigned by storage 115, based on the information on the external load information table 901 that the distributed file management section 112 is obtained from the external state Management Department 811, "remaining capacity" of the storage section is more than a predetermined capacity, and a "load" chooses other server computers with the storage with which the storage section lower than a predetermined threshold exists, and the partial file which is not assigned yet -- being concerned -- others -- the storage section of the storage of a server computer -- order -- assigning -- this allocation -- being concerned -- others -- it notifies to a server computer And it judges whether all partial files assigned the storage section of each storage of a server computer, and have created (Step 1002).

[0098] Here, when creating the distributed file A, the distributed file management section 112 assigns the partial file A1 (126a) to the predetermined storage section of the storage 115 of the server computer A805 based on the storage load information table 401 of the state Management Department 814. Moreover, the distributed file management section 112 assigns the partial file A2 (126c) and the partial file A3 (126d) to each storage section of the storage 125 of the server computer C807 based on the storage load information on the external load information table 901 of the external state Management Department 811.

[0099] Thus, the server computer A805 can determine the server computer which arranges a partial file (storage), taking into consideration other loads and remaining capacity of a server computer without asking other server computers whether creation of a partial file is possible by acquiring the load of other server computers, and the information on remaining capacity from the external state Management Department 811.

[0100] Next, the distributed file management section 112 registers the management information of a distributed file into the distributed file control table 501 as shown in drawing 5, and the partial file control table 601 as shown in drawing 6 (Step 1003). In drawing 5, the distributed file control table 501 consists of items of "the partial file identification child list of [ for discriminating the partial file which constitutes the "distributed file identification child" and distributed file for discriminating a distributed file ]." Moreover, in drawing 6, the partial file control table 601 consists of items of the "address" which shows the "partial file identification child" for discriminating a partial file, and the address of a partial file. Here, the "partial file identification child" who showed drawing 6 is equivalent to the "partial file identification child" who constitutes the "partial file identification child list" shown by drawing 5.

[0101] Here, in the case of the distributed file A, in drawing 5, it means that the distributed file A consists of a partial file A1 (126a), a partial file A2 (126c), and a partial file A3 (126d). Moreover, in drawing 6, the address of the partial file A1 (126a) is "file://siteA/serverA/DiskID1/(storage identifier DiskID1 of the server computer A105 of the computer site A102)." The address of the partial file A2 (126c) is "file://siteC/serverC/DiskID2/(storage identifier DiskID2 of the server computer C107 of the computer site C104)." The address of the partial file A3 (126d) expresses that it is "file://siteC/serverC/DiskID2/(storage identifier DiskID2 of the server computer C107 of the computer site C104)." [0102] Next, the distributed file management section 112 writes the data from the client computer 1 (108-1) in the predetermined storage section of storage 115 through the partial file management section 111, when recording a partial file on the storage section of storage 115.

Moreover, in recording a partial file on the storage of other server computers, the distributed file management section 112 requests record of a partial file from the distributed file management section of the server computer which records. It can come, simultaneously it points to the distributed file management section 112 to the client computer 1 (108-1) which performed the creation demand of a distributed file, and directs to transmit immediate data to the server computer which records. By the server computer which received the request from the distributed file management section 112, the data of a partial file are received from the client computer 1 (108-1), and it records on the predetermined storage section of storage. Moreover, the distributed file management section of this server computer registers the information on a partial file to the partial file control table 601 of the partial file management section. Thus, a partial file is created on other server computers (Step 1004).

[0103] In the case of the distributed file A, creation of the partial file A1 (126a) is performed by writing the data from the client computer 1 (108-1) in the predetermined storage section of storage 115. Creation of the partial file A2 (126c) and the partial file A3 (126d) sends predetermined data to the direct server computer C807 from the client computer 1 (108-1), and is performed by writing in the predetermined storage section of the storage 125 of the server computer C807, respectively.

[0104] On the other hand, at Step 1002, when a partial file cannot be created to all the server computer, either, the distributed file management section 112 notifies that creation of a distributed file went wrong to the client computer 1 (108-1) which required distributed file creation (Step 1005).

[0105] As mentioned above, although creation of a distributed file was explained, about the case where reference/updating demand of a distributed file is published from a client computer to a server computer, it is the same as that of the case (drawing 7) of the gestalt of the 1st operation.

[0106] As mentioned above, it sets in the gestalt of operation of the 2nd of this invention. By having the external state Management Department 811, 812, and 813 where the state Management Department 814, 819, and 824 holds the external load information which notified load information to other server computers, and was notified from other server computers. The distributed file management sections 112, 117, and 122 can determine the server computer which arranges the partial file of a distributed file based on the load information on other server computers, and can avoid concentration of the load to a specific server computer.

[0107] In addition, in case storage load information is notified to each server computer from the external state Management Department 811, 812, and 813, it is good to use a unicast and multicasting. When multicasting is used especially, storage load information can be notified to all server computers all at once, and the traffic for a notice can be reduced.

[0108] Moreover, the server computer to notify is beforehand divided into two or more groups, and it can also notify to each of the server computer belonging to each group by the unicast, and can also notify by multicasting to each group. Thus, the traffic for a notice can be reduced. [0109] Furthermore, the server computer to notify can be limited to an adjoining server computer, i.e., the server computer connected directly in the network, and a unicast or multicasting can also notify. Thereby, the traffic for a notice can be reduced.

[0110] (Gestalt 3 of operation) Drawing 11 is the block diagram showing an example of the gestalt of operation of the 3rd of the distributed file management system in this invention. In this drawing 11, the same sign is given to the same composition as drawing 8. The distributed file management system shown in drawing 11 is equipped with the networks 101, such as a Local Area Network which connects mutually two or more computers site A1102 equipped with the client computer group which consists of two or more client computers, such as server computers, such as a personal computer and a workstation, and a personal computer, and a workstation, the computer site B1103 and the computer site C1104, and the computer site A1102 and the computer site B1103, and the computer site C1104, and a Wide Area Network.

[0111] Here, the computer site A1102 is equipped with two or more server computers (only "the server computer A1105" is shown in drawing 11), such as a personal computer and a workstation, and the client computer group A108 which consists of client computer 1-n (108-1 - 108-n), such as a personal computer and a workstation. This computer site A1102 has connected two or more server computers (only "the server computer A1105" is shown in drawing 11) and client computer groups A108 in the internal networks 131, such as Ethernet, for example, has become the Internet domain.

[0112] Moreover, like the computer site A1102, the computer site B1103 was equipped with the client computer group B109 which consists of two or more server computers (only "the server computer B1106" is shown in drawing 11), and two or more client computers, and the computer site C1104 is equipped with the client computer group C110 which consists of two or more server computers (only "the server computer C1107" is shown in drawing 11), and two or more client computers. Furthermore, these computer sites B1103 and the computer site C1104 -- the computer site A1102 -- the same -- two or more server computers (in drawing 11, only the "server computer B1106" and the "server computer C1107" are shown), and the client computer groups B109 and the client computer groups C110 -- each -- it has connected in the internal network 132 and the internal network 133, for example, has become the Internet domain [0113] The storage 115, such as a hard disk with which the server computer A1105 records the partial file of a distributed file. The network interface 113 for connecting with the internal networks 131, such as Ethernet. The partial file management section 111 which controls the writing and read-out to the storage 115 which is recording the partial file. With the state Management Department 814 which supervises the load to storage 115, the remaining capacity of storage 115, and the load to a network interface 113, and holds the information about such loads and capacity. It is constituted by the partial file management section 111, the state

Management Department 814, and the distributed file management section 1112 connected to the network interface 113.

[0114] This state Management Department 814 has the external state Management Department 811 holding the external load information which notified load information to other server computers, and was notified from other server computers.

[0115] Moreover, the distributed file management section 1112 determined the partial file to which it is made to move based on the information on the access information for every partial file, and the load information external load information table 401 and 901, and is equipped with the distributed file move section 1131 which moves a partial file to other server computers.

[0116] The server computer B1106 and the server computer C1107 have the same composition as the server computer A1105. That is, the server computer B1106 is constituted by storage 120, a network interface 118, the partial file management section 116, the state Management Department 819 having the external state Management Department 812, and the distributed file management section 1117 equipped with the distributed file move section 1132. Moreover, the server computer C1107 is constituted by storage 125, a network interface 123, the partial file management section 121, the state Management Department 824 having the external state Management Department 813, and the distributed file management section 1122 equipped with the distributed file move section 1133.

[0117] The difference with the distributed file management system shown in the distributed file management system shown in drawing 11 and drawing 8 here is a point equipped with the distributed file move sections 1131, 1132, and 1133 which the distributed file-management sections 1112, 1117, and 1122 shown in drawing 11 determine the partial file to which it is made to move, and make move a partial file to other server computers from the information on the access information for every partial file, and the load information external load information table 401 and 901.

[0118] Drawing 12 shows an example of the access information table 1201 for every partial file managed at the state Management Department 814. In drawing 12, this access information table 1201 consists of a "partial file identification child" for discriminating a partial file, and an item of "the access information around unit time." Moreover, "the access information around unit time" consists of items of "the number of times of access" which indicates the number of times of access to a partial file to be the "accessing agency site identifier" which is the information on a site that the client computer which has accessed the partial file exists. It is continued by updating this access information table 1201 the state Management Department 814 for every unit time.

[0119] Drawing 13 shows an example of the partial file control table 1301 managed in the distributed file management section 1112. In drawing 13, the partial file control table 1301 consists of items of the "original address" which shows the "address" which shows the "partial file identification child" for discriminating a partial file, and the address of a partial file, and the address where the partial file was created first. In drawing 13, in the stage where the partial file was created, although the information which an "address" and an "original address" show is the same, the information on an "address" changes according to a partial file moving to other server computers. The partial file control table 1301 shown by drawing 13 is what added the item of an "original address" to the partial file control table 601 shown by drawing 6.

[0120] In the distributed file management system constituted as mentioned above, as the distributed file A, the distributed file B, and the distributed file C show by \*\*\*\*, after they are created by the server computer A1105, the processing which moves the partial file of each distributed file is explained in detail.

[0121] Drawing 14 shows an example of the contents of the partial file control table 1301 of the distributed file A created by the server computer A1105, the distributed file B, and the distributed file C. In drawing 14, drawing 14 (A) shows the partial file control table 1401 of the server computer A1105, (B) shows the partial file control table 1402 of the server computer B1106, and (C) shows the partial file control table 1403 of the server computer C1107. The address of each partial file where a partial file identification child is shown by A1, A2, A3, B1, C1, and C2, and the original address are shown in the partial file control table 1401 of drawing 14 (A).

The address of each partial file where a partial file identification child is shown by C1 and C2, and the original address are shown in the partial file control table 1402. The address of each partial file where a partial file identification child is shown by A2 and A3, and the original address are shown in the partial file control table 1403. Here, in drawing 14, the state before movement of each partial file is expressed. For this reason, in all partial files, the address and original address are in agreement.

[0122] The algorithm of the distributed file move section 1131 of the server computer A1105 in the case of movement of the partial file in the state which showed in drawing 14 of operation is explained.

[0123] Drawing 15 shows the algorithm of the distributed file move section 1131 of operation. First, the distributed file move section 1131 supervises the information on the load information table 401 (drawing 4) which the state Management Department 814 has managed at intervals of fixed time (Step 1501).

[0124] The distributed file move section 1131 will look for the "partial file identification child" of the partial file included in this detected storage with reference to the partial file control table 1301, if it detects that the "load" of a certain storage exceeded the predetermined threshold (for example, it is values, such as 80 etc.%, and the structure of a system etc. determines this value arbitrarily) set up beforehand (Step 1501). Discovered "the access information per unit time" of a "partial file identification child" is acquired from the access information table 1201. "the number of times of access" of "the access information per unit time" acquired here -- \*\* -- as compared with every partial file identification child", the "partial file identification child" who is biggest "number of times of access" is chosen (Step 1502). That is, a move dimension partial file is chosen. For example, suppose that the partial file A1 (126a) was chosen as a move dimension partial file here.

[0125] Next, the distributed file move section 1131 chooses the server computer in which "remaining capacity" appears enough and a "load" has low storage from a predetermined value based on the external load information table 901 (drawing 9). And the distributed file move section 1131 checks whether a partial file can move to the selected server computer, and determines the server computer which can move (Step 1502). That is, a movement place server computer is chosen. For example, suppose that the storage section of the storage 125 shown by the storage identifier DiskID2 of the server computer C1107 was chosen here.

[0126] Next, a partial file is moved based on the information acquired by selection of this move dimension partial file, and selection of a movement place server computer (Step 1503).

[0127] In an above-mentioned example, by Step 1502, since the server computer C1107 is chosen as a move dimension partial file as the partial file A1 (126a) and a movement place server computer, the distributed file move section 1131 of the server computer A1105 of a moved material reads the partial file A1 (126a) from storage 115 through the partial file management section 111. This read partial file A1 (126a) is sent out through a network interface 113 and the internal network 131 in a network 101 with the information about the "original address" (drawing 13) of the partial file A1 (126a).

[0128] On the other hand, in the server computer C1107 of a movement place, the distributed file move section 1133 receives the information on the partial file A1 (126a) sent out from the server computer A1105 of a moved material, and its "original address" through the interior network 133 of network 101 shell, and a network interface 123. The partial file management section 121 writes this partial file A1 (126a) that received in storage 125. Moreover, the "original address" of the partial file A1 (126a) is registered into the partial file control table (drawing 14 (C)) of the partial file management section 121.

[0129] Then, the server computer C1107 of a movement place notifies that movement of the partial file A1 (126a) was completed to the server computer (the server computer A1105 with the server computer A1105 same in the case of this example, i.e., a moved material and original) shown in the server computer A1105 and an "original address" (drawing 13) of a moved material. By the server computer shown in the server computer A1105 and an "original address" of a moved material, the information on the partial file A1 (126a) registered into the partial file control table is rewritten.

[0130] Drawing 16 shows the state of the partial file control tables 1401, 1402, and 1403 shown in drawing 14 after the partial file A1 (126a) moves like an above-mentioned example. In drawing 16, drawing 16 (A) shows the partial file control table 1601 of the server computer A1105, (B) shows the partial file control table 1602 of the server computer B1106, and (C) shows the partial file control table 1603 of the server computer C1107. That is, each partial file control table 1601, 1602, and 1603 of drawing 16 (A) - (C) correspond to each partial file control table 1401, 1402, and 1403 of drawing 14 (A) - (C), respectively. Here, the "address" of each partial file where a "partial file identification child" is shown by A1, A2, A3, B1, C1, and C2, and the "original address" are shown in the partial file control table 1601. The "address" of each partial file where a "partial file identification child" is shown by C1 and C2, and the "original address" are shown in the partial file control table 1602. The "address" of each partial file where a "partial file identification child" is shown by A1, A2, and A3, and the "original address" are shown in the partial file control table 1603. Here, the difference in the state of the partial file control tables 1401, 1402, and 1403 shown in the state and drawing 14 of the partial file control tables 1601, 1602, and 1603 shown in drawing 16 depends on the partial file A1 (126a) on having made it move to the server computer C1107 from the server computer A1105. Namely, the difference between drawing 16 and drawing 14 is set to the partial file control table 1401 of drawing 14 (A). The information registered as the "address" of the partial file A1 (126a) is "file://siteA/serveA/DiskID1/" in the partial file control table 1601 of drawing 16 (A). The "addresses" of the partial file A1 (126a) is "file://siteC/serveC/DiskID2/", the point registered, and the point that the item of the partial file A1 is added in the partial file control table 1603 of drawing 16 (C).

[0131] Drawing 17 shows a partial file control table when the distributed file move section 1132 of the server computer B1106 moves the partial file C1 (126e) to the server computer C1107 and the distributed file move section 1133 of the server computer C1107 moves the partial file A1 (126a) to the server computer B1106 like the processing mentioned above further from the state which showed in this drawing 16.

[0132] In drawing 17, drawing 17 (A) shows the partial file control table 1701 of the server computer A1105, (B) shows the partial file control table 1702 of the server computer B1106, and (C) shows the partial file control table 1703 of the server computer C1107. The "address" of each partial file where a "partial file identification child" is shown by A1, A2, A3, B1, C1, and C2, and the "original address" are shown in the partial file control table 1701. The "address" of each partial file where a "partial file identification child" is shown by C1, C2, and A1, and the "original address" are shown in the partial file control table 1702. Moreover, the "address" of each partial file where a "partial file identification child" is shown by A2, A3, and C1, and the "original address" are shown in the partial file control table 1703.

[0133] Here, the difference in the state of the partial file control tables 1601, 1602, and 1603 shown in the state and drawing 16 of the partial file control tables 1701, 1702, and 1703 shown in drawing 17 depends having moved the partial file A1 (126a) to the server computer B1106 from the server computer C1107, and the partial file C1 (126e) for having made it move to the server computer C1107 from the server computer B1106.

[0134] That is, corresponding to movement of the partial file A1 (126a), the item of the partial file A1 (126a) is added to the partial file control table 1702. Moreover, in the partial file control table 1703, the item (refer to drawing 16) of the partial file A1 (126a) is deleted. Furthermore, with reference to the "original address" of the partial file A1 (126a), the server computer B1106 told the server computer A1105 about movement, and has changed into "file://siteB/serveB/DiskID2/" the "address" of the partial file A1 (126a) registered into the partial file control table 1701 by this notice in the server computer A1105 shown in an "original address."

[0135] Moreover, corresponding to movement of the partial file C1 (126e), the "address" of the partial file C1 (126e) registered into the partial file control table 1702 is changed into "file://siteC/serveC/DiskID3/" from "file://siteB/serveB/DiskID3/" (drawing 16 (B)). Moreover, in the partial file control table 1703, the item of the partial file C1 (126e) is added. [0136] Next, in the state which shows in drawing 17, in case the client computer 1 (108-1)

refers to the distributed file C, operation in case the content of reference is included in the partial file C1 (126e) is explained.

[0137] (1) The client computer 1 (108-1) requires reference of the distributed file C from the server computer A1105 which created the distributed file C. By the server computer A1105, it investigates which partial file is referred to with reference to the distributed file control table 1701 among the partial files C1 and C2 which constitute the distributed file C. Here, it considers as the partial file C1 (126e). Since the "address" of the partial file C1 (126e) is "file://siteB/serveB/DiskID3/", the server computer A1105 checks whether the partial file C1 (126e) exists to the server computer B1106.

[0138] (2) The server computer B1106 investigates the distributed file control table 1702, and investigates the "address" of the partial file C1 (126e). Since the "address" of the partial file C1 (126e) is "file://siteC/serveC/DiskID3/", the server computer B1106 checks whether the partial file C1 (126e) exists to the server computer C1107.

[0139] (3) The server computer C1107 investigates the distributed file control table 1703, and investigates the "address" of the partial file C1 (126e). Since the "address" of the partial file C1 (126e) is "file://siteC/serveC/DiskID3/", it turns out that the partial file C1 (126e) exists in the server computer C1107.

[0140] (4) Notify that the server computer C1107 exists in the server computer B1106, and the partial file C1 (126e) exists in "file://siteC/serveC/DiskID3/."

[0141] (5) In response to this notice, the server computer B1106 notifies that the partial file C1 (126e) exists in the server computer A1105 at "file://siteC/serveC/DiskID3/."

[0142] (6) The server computer A1105 requires reference of the partial file C1 (126e) of the server computer C1107. Simultaneously with this demand, it directs to give the reference demand of the partial file C1 (126e) to the server computer C1107 directly to the client computer 1 (108-1) which required reference. Moreover, by the server computer A1105, the "address" of the partial file C1 (126e) is rewritten to "file://siteC/serveC/DiskID3/."

[0143] As mentioned above, with the gestalt of this operation, the distributed file management sections 1112, 1117, and 1122 determine the partial file to which it is made to move based on each information on the access information load information table [external load information] 1201, 401, and 901 for every partial file. Moreover, concentration of the load to the storage of a specific server computer is avoidable by moving a partial file to other server computers by having the distributed file move sections 1131, 1132, and 1133 which move a partial file to other server computers.

[0144] In addition, with the gestalt of the 3rd operation mentioned above, it sets to Step 1501 of the algorithm (drawing 15) of the distributed file move section 1131 of operation. Instead of detecting that the "load" of each storage section of storage exceeded the predetermined value, You may make it detect that "remaining capacity" of each storage section of storage was less than values (however, this value is determined according to equipment or the structure of a system), such as a predetermined value [Mbytes], 10 [for example,] etc. The imbalance of the capacity of each storage section of storage is avoidable with this.

[0145] Moreover, in the above-mentioned step 1501, "use communication-band width of face" can detect the link beyond the predetermined value (however, this value is determined according to equipment or the structure of a system), for example, the value of 80 [%] of usable communication-band width of face, from the "load information" on a network 101 instead of detecting that the "load" of each storage section of storage exceeded the predetermined value. Moreover, in Step 1502, concentration of the load of a network is avoidable by choosing from the access information table 1201 the computer site which is raising the partial file which is raising the load of a network 101, and the load of a network. For example, when the "use communication-band width of face" (drawing 4) of the link of the computer site A1102 (sending out agency site) and the computer site B1103 (sending-out place site) exceeds a predetermined value, it exists in the server computer A1105, and the partial file used as the cause which raises a network load is moved to the server computer B1103. Thereby, the "use communication-band width of face" between the computer site A1102 and the computer site B1103 can be decreased.



[0146] Moreover, with the gestalt of the 3rd operation of a \*\*\*\*, although it checks whether the partial file of the server computer of a movement place is movable in Step 1502 and the partial file is moved in Step 1503, check processing of Step 1502 can be omitted by moving a partial file, without whether movement of a partial file at Step 1502 is possible in advance, and checking. When movement of a partial file is unacceptable by the server computer side of the movement place of a partial file at this time, the server computer of a movement place looks for the movement place for moving a partial file further, and should just move this partial file.

[0147] moreover -- although it is moving to the server computer of a movement place from the server computer of a partial file move-origin in the above-mentioned step 1503 -- the move processing -- in addition, other partial files which can move to the server computer of a moved material out of the partial file in the server computer of a movement place -- choosing -- being concerned -- others -- you may make it move a partial file to the server computer of a moved material. This can protect that a partial file concentrates on one server computer, and the load to a file access can be mitigated more.

[0148] Moreover, in the above-mentioned step 1502, in case the server computer of the movement place of a partial file is chosen, it is good to choose the server computer in which a server computer list is beforehand set, has the remaining capacity of enough of each storage section of storage, and a load has low storage from a predetermined value out of the server computer under list. By this, the time spent on selection of the server computer of the movement place of a partial file can be shortened.

[0149] (Gestalt 4 of operation) Drawing 18 is a flow chart which shows other algorithms of the distributed file move sections 1131, 1132, and 1133 of distributed file management system of operation shown in drawing 11.

[0150] In drawing 18, the distributed file move sections 1131, 1132, and 1133 supervise the communication cost to each partial file at the predetermined intervals first (Step 1801). Here, as communication cost, it can consider as the communication time between the client computer which is referring to the partial file, and the server computer holding the partial file, for example. In drawing 11, communication cost of the client computer 1 (108-1) and the partial file A2 (126c) is taken as the communication time between the client computer 1 (108-1) which is referring to the partial file A2 (126c), and the server computer C1107 holding the partial file A2 (126c).

[0151] the distributed file move sections 1131, 1132, and 1133 exceeded the value predetermined in the communication cost to a partial file, for example, 1 etc. second etc., here (however, this value is determined according to equipment or the structure of a system) -- detecting (Step 1801) -- communication cost chooses as a partial file of partial file beyond predetermined value move-origin (Step 1802) Moreover, when two or more client computers have accessed to the partial file whose communication cost of this exceeded the predetermined value, it asks for the communication cost to each access, and these are added and it asks for sum total communication cost.

[0152] In case the server computer of a movement place is chosen, based on the external load information table 901, there is "remaining capacity" of enough of each storage section of storage, and the "load" to them chooses a server computer with low storage from a predetermined value. And as a result of transmitting above-mentioned sum total communication cost and moving a partial file to the selected server computer, it asks in order how communication cost changes, and the server computer which becomes the minimum communication cost is chosen (Step 1802). Or the distributed file move sections 1131, 1132, and 1133 have an initial entry between sites, expect communication cost from the initial entry, and you may make it choose the server computer which becomes the minimum communication cost (Step 1802).

[0153] Drawing 19 is drawing showing an example of an initial-entry table. In drawing 19, the initial-entry table 1901 has the item of "communication time" to show the communication cost from the "sending out agency site" which sends out a partial file, the "sending-out place site" where a partial file is sent out, and a sending out agency site to a sending-out place site. The "communication time" between a server computer and a client computer can be obtained from

[http://www4.ipdl.jp.go.jp/cgi-bin/tran\\_web\\_cgi.ejie](http://www4.ipdl.jp.go.jp/cgi-bin/tran_web_cgi.ejie)

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this initial-entry table 1901 by to which site the server computer holding a partial file belongs to which site, and the client computer which refers to a partial file belongs. Based on this "communication time" and the sum total communication cost mentioned above, the server computer by which "communication time" serves as the minimum after movement of a partial file is chosen as a movement place of a partial file (Step 1802). When two or more client computers have accessed the partial file whose communication cost exceeded the predetermined value here, it is good to choose the server computer by which the "communication time" after movement of a partial file becomes the minimum communication cost.

[0154] For example, when the communication cost (henceforth "cost A2") of the client computer 1 (108-1) and the partial file A2 (126c) exceeds a predetermined value and the partial file A2 (126c) is moved to the server computer A1105, it asks the server computer A1105 what communication cost becomes, or asks for communication cost from the initial-entry table 1901. The result will make the server computer A1105 the candidate of a movement place server computer, if less than cost A2. This processing is performed also to other server computers, and the server computer by which communication cost becomes the minimum is looked for (Step 1802).

[0155] Finally, a partial file is moved based on the information acquired by selection of this move dimension partial file, and selection (Step 1802) of a movement place server computer (Step 1803).

[0156] With the gestalt of the 4th operation, the distributed file move sections 1131, 1132, and 1133 As mentioned above, each information on the load information external load information table [access information] 401, 901, and 1201, it is based on the initial entry between the server computer obtained from the initial-entry table 1901, and a client computer. It asks for the communication cost between the server computer by which the partial file under processing exists, and the client computer of the demand origin of processing. Since the partial file was moved to other server computers which become small [communication cost] when communication cost exceeded a predetermined value in addition to the effect which was mentioned above and which is acquired with the gestalt of the 3rd operation, the average of the access time to the partial file from a client computer can be shortened.

[0157] In addition, although communication time is mentioned as the example with the gestalt of the 4th operation of a \*\*\*\* as communication cost, it can also be made "delay" of communication time, "fluctuation (range of fluctuation) etc.", etc.

[0158] Moreover, although the partial file is moved with the gestalt of the 4th operation of a \*\*\*\* so that sum total communication cost may be made into the minimum when two or more client computers have accessed the same partial file, you may make it move a partial file so that average communication cost may be made into the minimum.

[0159] (Gestalt 5 of operation) Drawing 20 is the block diagram showing an example of the gestalt of operation of the 5th of the distributed file management system in this invention. In this drawing 20, the same sign is given to the same composition as drawing 8. The distributed file management system shown in drawing 20 is equipped with the networks 101, such as a Local Area Network which connects mutually two or more computers site A2002 equipped with the client computer group which consists of two or more client computers, such as server computers, such as a personal computer and a workstation, and a personal computer, and a workstation, the computer site B2003 and the computer site C2004, the computer site A2002 and the computer site B2003, and the computer site C2004, and a Wide Area Network.

[0160] Here, the computer site A2002 is equipped with two or more server computers (only "the server computer A2005" is shown in drawing 20), such as a personal computer and a workstation, and the client computer group A108 which consists of client computer 1-n (108-1 - 108-n), such as a personal computer and a workstation. This computer site A2002 has connected two or more server computers (only "the server computer A2005" is shown in drawing 20) and client computer groups A108 in the internal networks 131, such as Ethernet, for example, has become the Internet domain.

[0161] Moreover, like the computer site A2002, the computer site B2003 was equipped with the

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client computer group B109 which consists of two or more server computers (only "the server computer B2006" is shown in drawing 20 ), and two or more client computers, and the computer site C2004 is equipped with the client computer group C110 which consists of two or more server computers (only "the server computer C2007" is shown in drawing 20 ), and two or more client computers, furthermore, these computer sites B2003 and the computer site C2004 — the computer site A2002 — the same — two or more server computers (in drawing 20, only the "server computer B2006" and the "server computer C2007" are shown), and the client computer groups B109 and the client computer groups C110 — each — it has connected in the internal network 132 and the internal network 133, for example, has become the Internet domain [0162] The storage 115, such as a hard disk with which the server computer A2005 records the partial file of a distributed file, The network interface 113 for connecting with the internal networks 131, such as Ethernet. The partial file management section 111 which controls the writing and read-out to the storage 115 which is recording the partial file, With the state Management Department 814 which supervises the load to storage 115, the remaining capacity of storage 115, and the load to a network interface 113, and holds the information about such loads and capacity It is constituted by the partial file management section 111, the state Management Department 814, and the distributed file management section 2012 connected to the network interface 113.

[0163] This state Management Department 814 has the external state Management Department 811 holding the external load information which notified load information to other server computers, and was notified from other server computers.

[0164] Moreover, the distributed file management section 2012 determined the partial file to copy based on each information for every partial file obtained from the access information load information table [ external load information ] 1201 ( drawing 12 ), 401 ( drawing 4 ), and 901 ( drawing 9 ), and is equipped with the distributed file copy section 2001 which copies the partial file concerned to other server computers.

[0165] The server computer B2006 and the server computer C2007 have the same composition as the server computer A2005. That is, the server computer B2006 is constituted by storage 120, a network interface 118, the partial file management section 116, the state Management Department 819 having the external state Management Department 812, and the distributed file management section 2017 equipped with the distributed file copy section 2032. Moreover, the server computer C2007 is constituted by storage 125, a network interface 123, the partial file management section 121, the state Management Department 824 having the external state Management Department 813, and the distributed file management section 2022 equipped with the distributed file copy section 2033.

[0166] The differences with the distributed file management system shown here in the distributed file management system shown in drawing 20 and drawing 8 are the distributed file copy sections 2031 and 2032 which determine the partial file which the distributed file—management sections 2012, 2017, and 2022 shown in drawing 20 copy based on each information for every partial file obtained from the access information load information table [ external load information ] 1201, 401, and 901, and copy the partial file concerned to other server computers, and a point equipped with 2033 \*\*.

[0167] Operation of the distributed file management system constituted as mentioned above is explained in detail taking the case of the case where a partial file is copied, after being created, as the distributed file A, the distributed file B, and the distributed file C show drawing 20 by the server computer A2005.

[0168] Drawing 21 is a flow chart which shows the algorithm of the distributed file copy section 2031 of the server computer A2005 of operation. In drawing 21, the distributed file copy section 2031 supervises first the load information table 401 ( drawing 4 ) which the state Management Department 814 has managed by the predetermined time interval (Step 2101). [0169] as for the distributed file copy section 2031, the "load" of the arbitrary storage sections of storage 115 exceeded values, such as a predetermined value [X], 80 [ for example, ] etc., — detecting (Step 2101) — the partial file included in the storage section of the detected storage 115 is discovered with reference to the partial file control table 1301 ( drawing 13 ) And the

access information on the discovered partial file is acquired from the access information table 1201. "The number of times of access" of the acquired access information is compared, and the partial file which is biggest "number of times of access" is chosen as a copy dimension partial file. Here, suppose that the partial file A1 (126a) was chosen. Next, based on the external load information table 901 ( drawing 9 ), there is "remaining capacity" of enough of the storage section of storage, and the server computer in which a "load" has low storage from a predetermined value is chosen. And it checks whether a partial file can be copied to the selected server computer, and the server computer which can be copied is chosen as a copy place server computer (Step 2102).

[0170] Here, suppose that the storage section (storage identifier : DiskID2) of the storage 125 of the server computer C2007 was chosen.

[0171] Based on the information acquired by selection of this copy dimension partial file, and selection of a copy place server computer, a partial file is copied (Step 2103) and surveillance processing of Step 2101 is continued again.

[0172] Since the server computer C2007 was chosen as a copy dimension partial file at Step 2102 as the partial file A1 (126a) and a copy place server computer in the case of the above-mentioned example, here The distributed file copy section 2031 of the server computer A2005 of a copied material Through the partial file management section 111, the partial file A1 (126a) is read from storage 115, and this partial file A1 (126a) is sent out to a network 101 through a network interface 113. Moreover, the information about the "original address" ( drawing 13 ) of the partial file A1 (126a) is also sent out simultaneously.

[0173] On the other hand, by the server computer C2007 of a copy place, the distributed file copy section 2033 receives the partial file A1 (126a) sent out from the server computer A2005 of a copied material through a network interface 123. And it writes in the predetermined storage section of storage 125 through the partial file management section 121. Moreover, the "original address" of the partial file A1 (126a) is received, and it registers with the partial file control table 1403. Then, the server computer C2007 of a copy place notifies that the copy of the partial file A1 (126a) was completed to the server computer (in the case of this example, an "original address" is the storage section of the storage 115 of the server computer A2005) shown in the server computer A2005 and an "original address" of a copied material. By the server computer (both server computer A2005) shown in the server computer and an "original address" of a copied material, the information on the partial file A1 (126a) of the partial file control table 1401 is rewritten.

[0174] Drawing 22 is drawing showing the partial file control table of the server computer after copy processing. The partial file control tables 1401, 1402, and 1403 shown in drawing 14 change to the state of the partial file control tables 2201, 2202, and 2203 shown in drawing 22 as a result of the copy of the above-mentioned partial file A1 (126a). That is, drawing 22 (A) shows the partial file control table 2201 of the server computer A2005, (B) shows the partial file control table 2202 of the server computer B2006, and (C) shows the partial file control table 2203 of the server computer C2007. Moreover, the "address" of each partial file where a "partial file identification child" is shown by A1, A2, A3, B1, C1, and C2, and the "original address" are shown in the partial file control table 2201. Moreover, the "address" of each partial file where a "partial file identification child" is shown by C1 and C2, and the "original address" are shown in the partial file control table 2002. Moreover, the "address" of each partial file where a "partial file identification child" is shown by A1, A2, and A3, and the "original address" are shown in the partial file control table 2203. The difference between the state of a partial file control table shown in drawing 14 and the state of a partial file control table shown in drawing 22 is a difference by having copied the partial file A1 (126a) to the server computer C2007 from the server computer A2005. Namely, it sets to the partial file control table 1401 of drawing 14 (A). As opposed to the "address" of the partial file A1 (126a) being "file://siteA/serverA/DiskID1/" In the partial file control table 2201 of drawing 22 (A) The point that "address" \*\* is "file://siteA/serverA/DiskID1/" and "file://siteC/serverC/DiskID2/(address of a copy)" is different. [ of the partial file A1 (126a) ] Furthermore, in the partial file control table 2103 of drawing 22 (C), the item of the partial file A1 (126a) is added.

[0175] Moreover, from the state of drawing 22, the distributed file copy section 2032 of the server computer B2006 can copy the partial file C1 (126e) to the server computer C2007, and the distributed file copy section 2033 of the server computer C2007 can also copy the partial file A1 (126a) to the server computer B2006.

[0176] Drawing 23 is drawing showing the partial file control table in the state where the partial file was copied further, from the state of drawing 22. Drawing 23 (A) shows the partial file control table 2301 of the server computer A2005, (B) shows the partial file control table 2302 of the server computer B2006, and (C) shows the partial file control table 2303 of the server computer C2007. The "address" of each partial file of A1, A2, A3, B1, C1, and C2 and the "original address" are shown for the "partial file identification child" in the partial file control table 2301 of drawing 23 (A). The "address" of each partial file of C1, C2, and A1 and the "original address" are shown for the "partial file identification child" in the partial file control table 2302 of drawing 23 (B). Moreover, the "address" of each partial file of A1, A2, A3, and C1 and the "original address" are shown for the "partial file identification child" in the partial file control table 2303 of drawing 23 (C). The difference between the state of the partial file control table of drawing 22 and the state of the partial file control table of drawing 23 is because the partial file C1 (126e) was copied [having copied the partial file A1 (126a) to the server computer B2006 from the server computer C2007, and ] to the server computer C2007 from the server computer B2006.

[0177] That is, corresponding to the copy of the partial file A1 (126a), the item of the partial file A1 (126a) is added in the partial file control table 2302. Moreover, the server computer A2005 of an "original address" has added "file://siteB/serverB/DiskID2/" to the "address" of the partial file A1 (126a) in the partial file control table 2301 because the server computer B2006 tells the server computer A2005 about a copy with reference to the "original address" of the partial file A1 (126a). Moreover, corresponding to the copy of the partial file C1 (126e), the item of the partial file C1 (126e) is added in the partial file control table 2303. Furthermore, in the partial file control table 2302, the "address" of the partial file C1 (126e) is "file://siteB/serverB/DiskID3/" and "file://siteC/serverC/DiskID3/(address of a copy)."

[0178] In the state which shows in drawing 23, in case the client computer 1 (108-1) refers to the distributed file C, operation in case the content of reference is included in the partial file C1 (126e) is explained.

[0179] (1) The client computer 1 (108-1) requires reference of the distributed file C from the server computer A2005 which created the distributed file C. By the server computer A2005, it investigates which partial file is referred to with reference to the distributed file control table 2301 among the partial files C1 and C2 which constitute the distributed file C, and recognizes that it is reference of the partial file C1 (126e). Since the "address" of the partial file C1 (126e) is "file://siteB/serverB/DiskID3/" in the distributed file control table 2301, the server computer A2005 checks whether the partial file C1 (126e) exists to the server computer B2006.

[0180] (2) The server computer B2006 investigates the distributed file control table 2302, and investigates the address of the partial file C1 (126e). Since the "addresses" of the partial file C1 (126e) is "file://siteB/serverB/DiskID3/" and "file://siteC/serverC/DiskID3/" in the distributed file control table 2302, the server computer B2006 chooses the low server computer of a load from the load information table 401 and the external load information table 901 among the server computer B2006 and the server computer C2007. Here, when the server computer C2007 is chosen, the server computer B2006 checks whether the partial file C1 (126e) exists to the server computer C2007.

[0181] (3) The server computer C2007 investigates the distributed file control table 2303, and checks the "address" of the partial file C1 (126e). Since the "address" of the partial file C1 (126e) is "file://siteC/serverC/DiskID3/" in the distributed file control table 2303, it turns out that the partial file C1 (126e) exists in the server computer C2007.

[0182] (4) The server computer C2007 notifies that the partial file C1 (126e) exists at "file://siteC/serverC/DiskID3/" to the server computer B2006.

[0183] (5) The server computer B2006 notifies that the partial file C1 (126e) exists at "file://siteC/serverC/DiskID3/" to the server computer A2005.

[0184] (6) The server computer A2005 requires reference of the partial file C1 (126e) of the server computer C2007. Simultaneously with this demand, it is directed that the client computer 1 (108-1) gives the reference demand of the partial file C1 (126e) to the server computer C2007 directly to the client computer 1 (108-1) which required reference.

[0185] With the gestalt of this operation, as mentioned above, the distributed file management sections 112, 117, and 122 it is based on each information for every partial file obtained from the access information load information table [external load information ] 1201, 401, and 901. When the partial file to copy is determined and the distributed file copy sections 2031, 2032, and 2033 copy a partial file to other server computers, concentration of the load to the storage of a specific server computer is avoidable.

[0186] In addition, with the gestalt of the 5th operation, you may decide to replace with detecting the thing which were mentioned above and for which the "load" of each storage section of storage exceeded the predetermined value, and to detect the link whose use communication-band width of face" of the network load information table 403 exceeded the predetermined value in Step 2101 of the algorithm ( drawing 21 ) of the distributed file copy section 2031 of operation. Moreover, you may make it choose from the access information table 1201 the partial file which is raising the network load, and the computer site which is raising the network load in Step 2102. Concentration of a network load is avoidable with this. For example, when the "use communication-band width of face" of the link of the computer site A2002 (sending out agency site) and the computer site B2003 (sending-out place site) exceeds as the predetermined value, it exists in the server computer A2005, and the partial file used as the cause which raises a network load is copied to the server computer B2003. Thereby, the "use communication-band width of face" between the computer site A2002 and the computer site B2003 decreases.

[0187] Drawing 24 is a flow chart which shows other algorithms of the distributed file copy section 2031 of the server computer A2005 of operation. In drawing 24, the distributed file copy section 2031 supervises the communication cost to a partial file at the predetermined intervals first (Step 2401).

[0188] Here, it can consider as the communication time between the client computer which is referring to for example, the partial file, and the server computer holding the partial file at communication cost. For example, what is necessary is just to make it into the communication time between the client computer 1 (108-1) which is referring to the partial file A2 (126c), and the server computer C2007 holding the partial file A2 (126c) in the case of the communication cost of the client computer 1 (108-1) and the partial file A2 (126c).

[0189] Next, the distributed file copy section 2031 chooses the partial file to which this communication cost exceeded the predetermined value as a copy dimension partial file, when the communication cost to a partial file detects having exceeded the predetermined value (Step 2401). When two or more client computers have accessed the partial file whose communication cost exceeded the predetermined value, it asks for each communication cost for every access, and these are added to it and it is asked for sum total communication cost. When choosing the server computer of a copy place, as a result of there having been "remaining capacity" of enough of the storage section of storage, and choosing the server computer in which a "load" has low storage, transmitting sum total communication cost to the selected server computer and copying a partial file on the other hand based on the external load information table 901, it is asked in order how communication cost changes. And the server computer which becomes the minimum communication cost is chosen as a copy place server computer. Or as an initial entry between sites (between a server computer and client computers), the distributed file copy sections 2031, 2032, and 2033 have the initial-entry table 1901 shown in drawing 19, expect communication cost (communication time) from the information, and you may make it choose the server computer which becomes the minimum communication cost. The "communication time" between a server computer and a client computer can be obtained using the information on the initial-entry table 1901 of drawing 19, and the information on to which site a server computer belongs to which site and a client computer belongs. And it is good to choose the server computer by which the "communication time" serves as the minimum as a copy place of a

partial file. When two or more client computers have accessed the partial file whose communication cost exceeded the predetermined value, the server computer which becomes the minimum sum total communication cost is chosen as a copy place server computer (Step 2402). [0190] For example, when the communication cost (cost A2) of the client computer 1 (108-1) and the partial file A2 exceeds a predetermined value and the partial file A2 is copied to the server computer A105, it is asked to the server computer A105 what communication cost becomes. Or it asks for cost from an initial entry 1801. The result will make the server computer A105 the candidate of a copy place, if less than cost A2. This processing is repeated and the server computer by which communication cost becomes the minimum is looked for. Based on the information acquired by selection of this copy dimension partial file, and selection of a copy place server computer, a partial file is copied (Step 2403) and surveillance processing of Step 2401 is continued again.

[0191] Thus, the average of the access time to the partial file from a client computer can be shortened by changing Step 2101 and Step 2102 of drawing 21 into Step 2401 and Step 2402 of drawing 24. Moreover, although "communication time" is mentioned as the example as communication cost above, "delay" of communication time, "fluctuation (range of fluctuation) etc.", etc. are sufficient.

[0192] Moreover, in Step 2102 of drawing 21, and Step 2402 of drawing 24, although it checks whether the copy of a partial file is possible to the server computer of a copy place and the partial file is copied to it in Step 2103 and Step 2403, check processing of Step 2102 and Step 2402 can be omitted by copying a partial file, without checking whether the copy of a partial file is possible to a server computer at Step 2102 and Step 2402. When the copy of a partial file cannot be accepted by the server computer side of a copy place in Step 2103 and Step 2403 at this time [whether the server computer of a copy place copies a partial file in search of the copy place for copying a partial file further, and] Or you may make it notify having canceled the partial file transmitted to the copy and having canceled the partial file for a copy to the server computer of a copied material.

[0193] Moreover, although the partial file is only copied to the server computer of a copy place from the server computer of a copied material in Step 2103 of drawing 21, and Step 2403 of drawing 24 with the gestalt of the 5th operation of a \*\*\* In addition to the copy processing, the partial file which may make it move to the server computer of a copied material is chosen from the partial files in the server computer of a copy place, and you may make it move to the server computer of the partial file move-origin. By this, a partial file cannot concentrate on one server computer, but concentration of the load to the storage of a specific server computer can be avoided.

[0194] Moreover, in Step 2102 of drawing 21, in case the server computer of a copy place is chosen, the server computer list is set up beforehand, there is remaining capacity of enough of the storage section of storage out of the server computer under this server computer list, and the server computer in which a load has low storage can be chosen. The time for server selection can be shortened now by this.

[0195] (Gestalt 6 of operation) Drawing 25 is a flow chart which shows other algorithms of the distributed file copy section 2031 of the server computer A2005 in the distributed file management system shown in drawing 20 of operation. In the gestalt of this operation, it has the same composition as the gestalt of the 5th operation mentioned above, and if operation of the distributed file copy section is removed, same operation is performed. Hereafter, the algorithm of the distributed file copy section 2031 of operation is explained.

[0196] In drawing 25, the distributed file copy section 2031 supervises first the load information table 401 (drawing 4) which the state Management Department 814 has managed by the predetermined time interval (Step 2501).

[0197] as for the distributed file copy section 2031, the "load" of the arbitrary storage sections of storage 115 exceeded values, such as a predetermined value [%], 80 [for example,] etc., -- detecting (Step 2501) -- the partial file included in the detected storage is discovered with reference to the partial file control table 1301 (drawing 13) And "the access information per unit time" on the discovered partial file is acquired from the access information table 1201. "The

number of times of access" of the acquired "the access information per unit time" is compared, and the partial file which is biggest "number of times of access" is chosen as a copy dimension partial file (Step 2502). Here, suppose that the partial file A1 was chosen, for example.

[0198] Next, based on the external load information table 901 (drawing 9), there is "remaining capacity" of enough of the storage section of storage, and two or more server computers in which a "load" has low storage from a predetermined value are chosen. And it checks whether a partial file can be copied to the selected server computer, and the server computer which can be copied is determined as a copy place server computer (Step 2502).

[0199] Here, suppose that the storage 120 which has the storage section shown by the storage identifier DiskID1 of the server computer B106, and the storage 125 which has the storage section shown by the storage identifier DiskID2 of the server computer C107 were chosen.

[0200] Next, based on the information on the copy dimension partial file obtained at the above-mentioned step 2502, and a copy place server computer, a partial file is copied (Step 2503) and surveillance processing of Step 2501 is continued.

[0201] In an above-mentioned example, since the server computer B2006 and the server computer C2007 were chosen as the partial file A1 (126a) and a copy place computer as a copy dimension partial file at Step 2502 The distributed file copy section 2031 of the server computer A2005 of a copied material minds the partial file management section 111. The partial file A1 (126a) is read from storage 115, and it transmits to a network 101 by multicasting through a network interface 113. Moreover, the information about the "original address" (drawing 13) of the partial file A1 (126a) is also transmitted simultaneously.

[0202] On the other hand, by the server computer B2006 and computer C2007 of a copy place, the distributed file copy sections 2032 and 2033 receive through network interfaces 118 and 123, and write the partial file A1 (126a) transmitted from the server computer A2005 of a copied material in storage 120 and 125 through the partial file management sections 116 and 121.

Moreover, the "original address" (drawing 13) of the partial file A1 (126a) is received, and it registers with each partial file control table 1402 and 1403 (drawing 14). Then, the server computer B2006 and the server computer C2007 of a copy place notify that the copy of the partial file A1 (126a) completed them to both and this server computer A2005 in the server computer shown in the server computer and an "original address" (drawing 13) of a copied material, respectively, i.e., this case, since both were the server computers A2005. The information on the partial file A1 (126a) of the partial file control table 1401 (drawing 14) is rewritten by the server computer A2005 shown in the server computer and an "original address" (drawing 13) of a copied material, i.e., a server computer.

[0203] As mentioned above, with the gestalt of this operation, since the candidate of the server computer of two or more copy places is chosen and a partial file is simultaneously copied to two or more selected server computers by multicasting communication in case the distributed file copy sections 2031, 2032, and 2033 copy a partial file to other server computers, the traffic in the case of the copy of a partial file is reducible.

[0204] (Gestalt 7 of operation) Drawing 26 is the block diagram showing an example of the gestalt of other operations of the distributed file management system in this invention. Here, in drawing 26, the same sign is given to the thing of the same composition as drawing 1. It set to drawing 26 and this distributed file management system is equipped with the networks 101, such as a Local Area Network which connects mutually two or more computers site A2602 equipped with the client computer group which consists of two or more client computers, such as server computers, such as a personal computer and a workstation, and a personal computer, and a workstation, the computer site B2603, and the computer site C2604, and a Wide Area Network.

[0205] Here, the computer site A2602 is equipped with two or more server computers (only "the server computer A2605" is shown in drawing 26), such as a personal computer and a workstation, and the client computer group A108 which consists of client computer 1-n (108-1 - 108-n), such as a personal computer and a workstation. This computer site A2602 has connected two or more server computers (only "the server computer A2605" is shown in drawing 26) and client computer groups A108 in the internal networks 131, such as Ethernet, for

example, has become the Internet domain.

[0206] Moreover, like the computer site A2602, the computer site B2603 was equipped with the client computer group B2609 which consists of two or more server computers (only "the server computer B2606" is shown in drawing 26), and two or more client computers, and the computer site C2604 is equipped with the client computer group C2610 which consists of two or more server computers (only "the server computer C2607" is shown in drawing 26), and two or more client computers. Furthermore, these computer sites B2603 and the computer site C2604 -- the computer site A2602 -- the same -- two or more server computers (in drawing 26, only the "server computer B2606" and the "server computer C2607" are shown), and the client computer groups B109 and the client computer groups C110 -- each -- it has connected in the internal network 132 and the internal network 133, for example, has become the Internet domain [0207] The storage 115, such as a hard disk with which the server computer A2605 records the partial file of a distributed file, The network interface 113 for connecting with the internal networks 131, such as Ethernet. The partial file management section 111 which controls the writing and read-out to the storage 115 which is recording the partial file, With the state Management Department 114 which supervises the load to storage 115, the remaining capacity of storage 115, and the load to a network interface 113, and holds the information about such loads and capacity. It is constituted by the partial file management section 111, the state Management Department 114, and the distributed file management section 2612 connected to the network interface 113.

[0208] This distributed file management section 2612 directs writing and read-out of a partial file in the partial file management section 111. Moreover, when creating a distributed file, based on the information acquired from the state Management Department 114, the distributed file management section 2612 divides a distributed file into two or more partial files, and determines the server computer which arranges each partial file (record). Moreover, in referring to or updating the distributed file created before, it detects the server (recorded) computer by which the partial file of the corresponding distributed file exists. Here, the distributed file management section 2612 is equipped with the partial file size determination section 2631 which determines the size of the partial file at the time of dividing a distributed file to a partial file according to the kind of data recorded on information or a distributed file from a client computer.

[0209] The server computer B2606 and the server computer C2607 have the same composition as the server computer A2605. That is, the server computer B2606 is constituted by storage 120, a network interface 118, the partial file management section 116, the state Management Department 119, and the distributed file management section 2617. Moreover, the server computer C2607 is constituted by storage 125, a network interface 123, the partial file management section 121, the state Management Department 124, and the distributed file management section 2622. Moreover, the distributed file management sections 2632 and 2633, respectively, are equipped with the partial file size determination sections 2632 and 2633, respectively.

[0210] The difference with the distributed file management system shown in the distributed file management system shown in drawing 26 and drawing here is a point equipped with the partial file size determination sections 2631, 2632, and 2633 which determine the size of the partial file at the time of dividing a distributed file to a partial file according to the kind of data recorded on the distributed file management sections 2612, 2617, and 2622 by information or a distributed file from a client computer in the distributed file management system of drawing 26.

[0211] Operation of the partial file size determination sections 2631, 2632, and 2633 of the distributed file management system constituted as mentioned above is explained below. [0212] In drawing 3, when the client computer 1 (108-1) performs the creation demand of the distributed file A to the server computer A2605, the partial file size determination section 2631 of the distributed file management section 2612 determines the size when assigning a portion by processing of Step 302. It is good to make it decide with the directions from the kinds (for example, M-JPEG, MPEG1, MPEG 2, etc.) and the client computer 1 (108-1) of data which the partial file size determination section 2631 records on a distributed file to determine the size of a partial file in the case.

[0213] As mentioned above, in the distributed file management system of the gestalt of this

operation, the partial file size determination sections 2631, 2632, and 2633 of the distributed file management sections 2612, 2617, and 2622 can change suitably the size of the partial file which constitutes a distributed file by determining the size of the partial file at the time of dividing a distributed file to a partial file according to the kind of data recorded on information and a distributed file from a client computer etc. Thereby, it can prevent dividing into two or more partial files, a logic target, the data which have relation in content, for example, the data for one picture etc., etc.

[0214] (Gestalt 8 of operation) Next, the distributed file management section and the state Management Department which two or more server computers mentioned above have are summarized to one server computer, and the case where it manages intensively by this server computer is explained.

[0215] Drawing 27 shows an example of the composition of the distributed managerial system at the time of summarizing the distributed file management section and the state Management Department to one server computer in the distributed file management system in this invention shown in the gestalt of the 1st operation. In drawing 27, the same sign is given to the thing of the same composition as drawing 1.

[0216] The distributed file management system shown in drawing 27 Two or more computer sites A2702, the computer site B2703 equipped with the client computer group which consists of two or more client computers, such as server computers, such as a personal computer and a workstation, and a personal computer, and a workstation. And the computer site X2710 equipped with the management server computer X2711 which manages intensively the distributed file arranged on the computer site C2704 and other server computers. It has the networks 101, such as a Local Area Network, which connects the computer site A2702, the computer site B2703, the computer site C2704, and the computer site X2710 mutually, and a Wide Area Network.

[0217] Here, the computer site A2702 is equipped with two or more server computers (only "the server computer A2705" is shown in drawing 27), such as a personal computer and a workstation, and the client computer group A108 which consists of client computer 1-n (108-1 ~ 108-n), such as a personal computer and a workstation. This computer site A2702 has connected two or more server computers (only "the server computer A2705" is shown in drawing 27) and client computer groups A108 in the internal networks 131, such as Ethernet, for example, has become the Internet domain.

[0218] Moreover, like the computer site A2702, the computer site B2703 was equipped with the client computer group B109 which consists of two or more server computers (only "the server computer B2706" is shown in drawing 27), and two or more client computers, and the computer site C2704 is equipped with the client computer group C110 which consists of two or more server computers (only "the server computer C2707" is shown in drawing 27), and two or more client computers. Furthermore, these computer sites B2703 and the computer site C2704 -- the computer site A2702 -- the same -- two or more server computers (in drawing 27, only the "server computer B2706" and the "server computer C2707" are shown), and the client computer groups B109 and the client computer groups C110 -- each -- it has connected in the internal network 132 and the internal network 133, for example, has become the Internet domain [0219] The server computer A2705 is constituted by the storage 115, such as a hard disk which records the partial file of a distributed file, the network interface 113 for connecting with the internal networks 131, such as Ethernet, and the partial file management section 111 that controls the writing and read-out to the storage 115 which is recording the partial file.

[0220] The server computer B2706 and the server computer C2707 have the same composition as the server computer A2705. That is, the server computer B2706 is constituted by storage 120, a network interface 118, and the partial file management section 116. Moreover, the server computer C2707 is constituted by storage 125, a network interface 123, and the partial file management section 121.

[0221] The network interface 2713 for connecting the management server computer X2711 to the internal networks 134, such as Ethernet With the state Management Department 2714 which supervises the load of the storage of each server computer, and the remaining capacity and the load of a network interface, and holds the information about a load Point to writing and read-out



of a partial file in the partial file management sections 111, 116, and 121 of each server computer, or in case a distributed file is created, a distributed file is divided into two or more partial files based on the information from the state Management Department 2714. In creating a partial file and referring to or updating a distributed file by determining the server computer which arranges each partial file it is constituted by the distributed file management section 2712 which detects the server computer which the partial file of the distributed file concerned referred to or updated \*\*\* and performs the reference or updating of a partial file.

[0222] In drawing 27, the state after each distributed files A, B, and C were created is shown. That is, the partial file A1 (126a) of the distributed file A and the partial file B1 (126b) of the distributed file B are recorded on the storage 115 of the server computer A2705. Moreover, the partial file C1 (126c) of the distributed file C and the partial file C2 (126f) of the distributed file C are recorded on the storage 120 of the server computer B2706. Moreover, the partial file A2 (126e) of the distributed file A and the partial file A3 (126d) of the distributed file A are recorded on the storage 125 of the server computer C2707.

[0223] Next, operation of the distributed file management system constituted as mentioned above is explained. The creation demand of the distributed file A is published to the server computer A2705 from the client computer 1 (108-1) of the client computer group A108 below, and distributed processing in case the partial files A1-A3 as shown in drawing 27 are created is made into an example, and is explained. Here, the storage 115, 120, and 125 shown in drawing 27 shall have two or more storage sections or storage regions (only henceforth the "storage section"), respectively. Two or more of these storage sections may be one record medium physically, and may be two or more record media.

[0224] In drawing 27, the creation demand of the distributed file A is first published by the management server computer X2711 of the computer site X2710 from the client computer 1 (108-1). The creation demand of this distributed file A is received by the distributed file management section 2712 through the internal network 131 of the computer site A2702, a network 101, the internal network 134 of the computer site X2710, and the network interface 2713 of the management server computer A2711.

[0225] Drawing 28 is a flow chart which shows the algorithm of the distributed file management section 2712 at the time of receiving the creation demand of a distributed file of operation. Hereafter, detailed operation of the distributed file management section 2712 is explained using drawing 27 and drawing 28.

[0226] Refer to the load information which the state Management Department 2714 has managed for the distributed file management section 2712 first in drawing 28 (Step 2801).

[0227] At the state Management Department 2714, a load information table 401 like drawing 4 is managed, for example, in drawing 4, although the information about the server computer A2705 is shown, at the state Management Department 2714, the load information table 401 as shown in drawing 4 is prepared and managed for every server computer. The load information table 401 consists of a storage load information table 402 and a network load information table 403 in drawing 4. The storage load information table 402 consists of information on the "storage identifier" for discriminating each storage section of the storage connected to the server computer, the "load" of each storage section of storage, and the "remaining capacity" of each storage section of storage. The "load" of each storage section of storage is displayed by what [%] is used among the maximum transfer rates of the storage section. The network load information table 403 means towards which site the data transmitted through the network interface of each server computer are transmitted using the bandwidth of how much, and whether it has received by sending TETRA which has received from which site using the bandwidth of how much. Moreover, a "sending out agency site" shows the computer site of the sending-out origin of data, a "sending-out place site" shows the computer site of the sending-out place of data, and the communication-band width of face for which "use bandwidth" is used between the computer site of a sending out agency and the computer site of a sending-out place is shown.

[0228] For example, when creating the distributed file A, about the storage section the storage identifier of the storage 115 of the server computer A2705 is indicated to be by DiskID1, the

"load" is 20 [%] and the distributed file management section 2712 can acquire the information that the "remaining capacity" is 10 [Mbytes].

[0229] Next, the distributed file management section 2712 is based on the "storage load information" acquired from the state Management Department 2714. From each storage sections of the storage connected to each server computer, the value of "remaining capacity" is larger than a predetermined value, and the value of a "load" chooses a predetermined value, for example, the storage which has the low storage section from 80 [%] (this value is determined according to the composition of a system or other equipments). And a partial file is assigned to the storage section of this storage in order. At this time, it is good to make size of a partial file into the same fixed length by all server computers. In quota processing of this partial file, it detects whether all partial files were able to be assigned (Step 2802).

[0230] Here, when creating the distributed file A, in drawing 27, the partial file A1 (126a) will be assigned to the server computer A2705, and the partial file A2 (126c) and the partial file A3 (126d) will be assigned to the server computer C2704.

[0231] When all partial files are able to be assigned, the distributed file management section 2712 registers the information for managing a distributed file into the distributed file control table 501 of drawing 5 and the partial file control table 601 of drawing 6 which were mentioned above (Step 2803).

[0232] In the above-mentioned example, as shown in drawing 5, the distributed file A consists of a partial file A1 (126a), a partial file A2 (126c), and a partial file A3 (126d).

[0233] Moreover, in drawing 6, the address of the partial file A1 (126a) is "file://siteA/serverA/DiskID1/(storage identifier DiskID1 of the server computer A105 of the computer site A102)." The address of the partial file A2 (126c) is "file://siteC/serverC/DiskID2/(storage identifier DiskID2 of the server computer C107 of the computer site C104)." The address of the partial file A3 (126d) expresses that it is "file://siteC/serverC/DiskID2/(storage identifier DiskID2 of the server C107 of the computer site C104)."

[0234] Next, the distributed file management section 2712 gives the creation demand of a partial file to the partial file management section of the server computer which creates in order to create the partial file registered at Step 2803 on each corresponding server computer.

Simultaneously with this creation demand, it directs to transmit data to the server computer 1 (108-1) which creates a direct partial file from the client computer 1 (108-1) to the client computer 1 (108-1) which performed the creation demand of a distributed file. By the server computer of which creation of a partial file was required, the data from the client computer 1 (108-1) are written in each storage section of storage by the partial file management section. The distributed file management section 2712 repeats this processing until creation of all partial files finishes (Step 2804).

[0235] Here, in creation of the partial file A1 (126a) of the distributed file A, the partial file management section 111 of the server computer A2705 writes the data from the client computer 1 (108-1) in the predetermined storage section of storage 115. Moreover, the partial file management section 121 of the server computer C2707 writes the data from the client computer 1 (108-1) in the predetermined storage section of storage 125, and creates the partial file A2 (126c) and the partial file A3 (126d).

[0236] On the other hand, at Step 2802, when all partial files are not able to be assigned, the distributed file management section 2712 notifies what creation processing of a distributed file went wrong to the client computer 1 (108-1) which performed the creation demand of a distributed file (Step 2805).

[0237] Next, the case where reference of a distributed file or the demand (henceforth "reference/updating demand") of updating is published from a client computer to a management server computer is explained. Moreover, the following explanation is described by making into an example the case where reference/updating demand of the distributed file A is published to the management server computer X2711 from the client computer 1 (108-1) in the client computer group A108.

[0238] First, reference/updating demand to the distributed file A published by the client computer 1 (108-1) is received by the distributed file management section 2712 through a



network interface 2713 in the management server computer X2711.

[0239] Drawing 29 is a flow chart which shows an algorithm of operation when the distributed file management section receives reference/updating demand of a distributed file. Hereafter, operation of the distributed file management section 2712 is explained using drawing 29.

[0240] First, the distributed file management section 2712 accepts reference/updating demand of the distributed file A from the client computer 1 (108-1), and it asks for the address of the partial file updated or referred to and its partial file from the distributed file control table 501 (drawing 5) and the partial file control table 601 (drawing 6) (Step 2901).

[0241] Here, in reference/updating demand of the distributed file A, the distributed file control table 501 (drawing 5) shows that the distributed file A is constituted by the partial file A1 (126a), the partial file A2 (126c), and the partial file A3 (126d). By the partial file control table 601 (drawing 6), moreover, the partial file A1 (126a) it exists in the storage section of the storage 115 shown by "f1e://siteA/serverA/DiskID1/", the partial file A2 (126c) it exists in the storage section of the storage 125 shown by "f1e://siteC/serverC/DiskID2/", the partial file A3 (126d) it turns out that it exists in the storage section of the storage 125 shown by "f1e://siteC/serverC/DiskID2/".

[0242] The distributed file management section 2712 performs reference/updating demand of the partial file concerned to the server computer holding the partial file corresponding to reference/updating demand from the client computer 1 (108-1). It is directed that the distributed file management section 2712 gives reference/updating demand to the server computer by which the partial file to which the client computer 1 (108-1) performs reference or updating exists to the client computer 1 (108-1) directly simultaneously with this demand. The partial file management section of each server computer writes in read-out (reference) of the partial file which exists in storage, or the partial file to storage based on reference/updating demand from the client computer 1 (108-1) according to the demand from the distributed file management section 2712 (Step 2902). (updating)

[0243] When it is the distributed file A here, in the partial file A1 (126a), the partial file A2 (126c) exists in the server computer C2707 of the computer site C2704, and the partial file A3 (126d) exists in the server computer A2705 of the computer site A2702 at the server computer C2707 of the computer site C2704. Therefore, processing of reference/updating demand to the partial file A1 (126a) is directly performed according to the demand from the distributed file management section 2712 between the client computer 1 (108-1) and the partial file management section 111. On the other hand, processing of reference/updating demand to the partial file A2 (126c) and the partial file A3 (126d) is directly performed according to the demand from the distributed file management section 2712 between the client computer 1 (108-1) and the server computer C2707.

[0244] As mentioned above, since management of a distributed file and management of the state of a system are performed [ according to the distributed file management system of the gestalt of this operation ] intensively in addition to the effect shown in the gestalt of the 1st operation, it is not necessary to have two or more duplicate Management Department, and simple [ of the system configuration ] can be carried out, and mitigation of cost can be aimed at.

[0245] In addition -- although explained as composition which concentrated the Management Department of distributed file management system which showed with the gestalt of the 1st operation on one management server computer in the distributed file management system of drawing 27 mentioned above -- the 2- is applicable also to the distributed file management system of the gestalt of operation shown by the 7th

[0246] Moreover, although the Management Department of distributed file management system was explained as composition concentrated on one management server computer, you may make it form a management server computer in the distributed file management system of drawing 27 mentioned above for every computer site of every server computer of a predetermined group, and a predetermined group. If it does in this way, concentration of the load to the management server computer in a large-scale system can be prevented.

[0247] Moreover, you may make it choose at random the server computer which you may make it use a server computer in order based on a predetermined rule, and it not only chooses it as

order with only small the "load" of a server computer, but has the "load" below a predetermined threshold in the gestalt of operation mentioned above in selection of a partial file in case a partial file exists in two or more server \*\*\*\* on a plane.

[0248]

[Effect of the Invention] As mentioned above, since arrangement of a partial file was determined at each Management Department of a client computer to the server computer demanded according to the demand of creation of the distributed file to a server computer, reference, or updating or a management server computer based on the load information on each server computer according to the distributed file management equipment and distributed file management system of this invention, concentration of the load to a specific server computer could be avoided.

[0249] Moreover, since the external load information which notified load information to other server computers, and was notified from other server computers was held and arrangement of a partial file was determined based on the load information on other server computers, concentration of the load to a specific server computer could be avoided.

[0250] Moreover, since the partial file to which it is made to move was determined based on the access information, load information, and external load information for every partial file and a partial file was moved to other server computers, the imbalance of the capacity of concentration of the load to the storage of a specific server computer and the storage of each server computer could be avoided.

[0251] Moreover, since the partial file to copy was determined based on the access situation, load information, and external load information for every partial file and a partial file was copied to other server computers, concentration of the load to the storage of a specific server computer could be avoided.

[0252] Moreover, since the size of the partial file which divides and creates a distributed file according to the kind of data recorded on information and a distributed file from a client computer determines, the size of the partial file which constitutes a distributed file can change suitably, and it could prevent dividing and recording in the data which have relation content-wise and logically, for example, the data for one picture etc., to two or more partial files.

[0253] Moreover, since duplication of a resource was suppressed to the minimum by centralizing each Management Department which manages the partial file of a distributed file on one or more administrative server computers, the increase in cost could be suppressed.

[Translation done.]

\* NOTICES \*

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- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

- [Drawing 1] It is the block diagram showing the distributed file management system of this invention.
- [Drawing 2] It is drawing showing the composition of the distributed file in this invention.
- [Drawing 3] It is the flow chart which shows the distributed file creation algorithm of the distributed file management section of this invention.
- [Drawing 4] It is drawing showing an example of the load information table in this invention.
- [Drawing 5] It is drawing showing an example of the distributed file control table of this invention.
- [Drawing 6] It is drawing showing an example of the partial file control table of this invention.
- [Drawing 7] It is the flow chart which shows reference/updating algorithm of the distributed file of the distributed file management section of this invention.
- [Drawing 8] It is the block diagram showing the distributed file management system of this invention.
- [Drawing 9] It is drawing showing an example of the external load information table in this invention.
- [Drawing 10] It is the flow chart which shows the distributed file creation algorithm of the distributed file management section in this invention.
- [Drawing 11] It is the block diagram showing the distributed file management system of this invention.
- [Drawing 12] It is drawing showing an example of the partial file access information table in this invention.
- [Drawing 13] It is drawing showing an example of the partial file control table in this invention.
- [Drawing 14] It is drawing showing an example of the partial file control table in this invention.
- [Drawing 15] It is the flow chart which shows the algorithm of the distributed file move section in this invention of operation.
- [Drawing 16] It is drawing showing an example of the partial file control table in this invention.
- [Drawing 17] It is drawing showing an example of the partial file control table in this invention.
- [Drawing 18] It is the flow chart which shows the algorithm of the distributed file move section in this invention of operation.
- [Drawing 19] It is drawing showing an example of the initial-entry table in this invention.
- [Drawing 20] It is the block diagram showing the distributed file management system of this invention.
- [Drawing 21] It is the flow chart which shows the algorithm of the distributed file copy section in this invention of operation.
- [Drawing 22] It is drawing showing an example of the partial file control table in this invention.
- [Drawing 23] It is drawing showing an example of the partial file control table in this invention.
- [Drawing 24] It is the flow chart which shows the algorithm of the distributed file copy section in this invention of operation.
- [Drawing 25] It is the flow chart which shows the algorithm of the distributed file copy section in this invention of operation.

- [Drawing 26] It is the block diagram showing the distributed file management system of this invention.
- [Drawing 27] It is the block diagram showing the distributed file management system of this invention.
- [Drawing 28] It is the flow chart which shows the distributed file creation algorithm of the distributed file management section of this invention.
- [Drawing 29] It is the flow chart which shows reference/updating algorithm of the distributed file of the distributed file management section of this invention.
- [Drawing 30] It is the block diagram showing conventional distributed file management equipment.

[Description of Notations]

- 101 Network
- 102-104, 802-804, 1102-1104, 2002-2004, 2602-2604, and 2702- 2704 and 2710 Computer site
- 105-107, 805-807, 1105-1107, 2005-2007, 2605-2607, 2705-2707 Server computer
- 108, 109, 110 Client computer group
- 108-1 - 108-n Client computer
- 111, 116, 121 Partial file management section
- 112, 117, 122, 1112, 1117, 1122, 2012, 2017, 2612, 2617, 2622, 2712 Distributed file management section
- 113, 118, 123, 2713 Network interface
- 114, 119, 124, 814, 819, 824, 2714 State Management Department
- 115, 120, 125 Storage
- 126a-126f, 202-1 - 202-n Partial file
- 131-133 Internal network
- 401 Load Information Table
- 402 Storage Load Information Table
- 403 Network Load Information Table
- 501 Distributed File Control Table
- 601, 1301, 1401-1403, 1601-1603, 1701-1703, 2201-2203, 2301-2303 Partial file control table
- 811, 812, 813 External state Management Department
- 901 External Load Information Table
- 1131, 1132, 1133 Distributed file move section
- 1201 Access Information Table
- 1901 Initial-Entry Table
- 2031, 2032, 2033 Distributed file copy section
- 2631, 2632, 2633 Partial file size determination section
- 2711 Management Server Computer

[Translation done.]